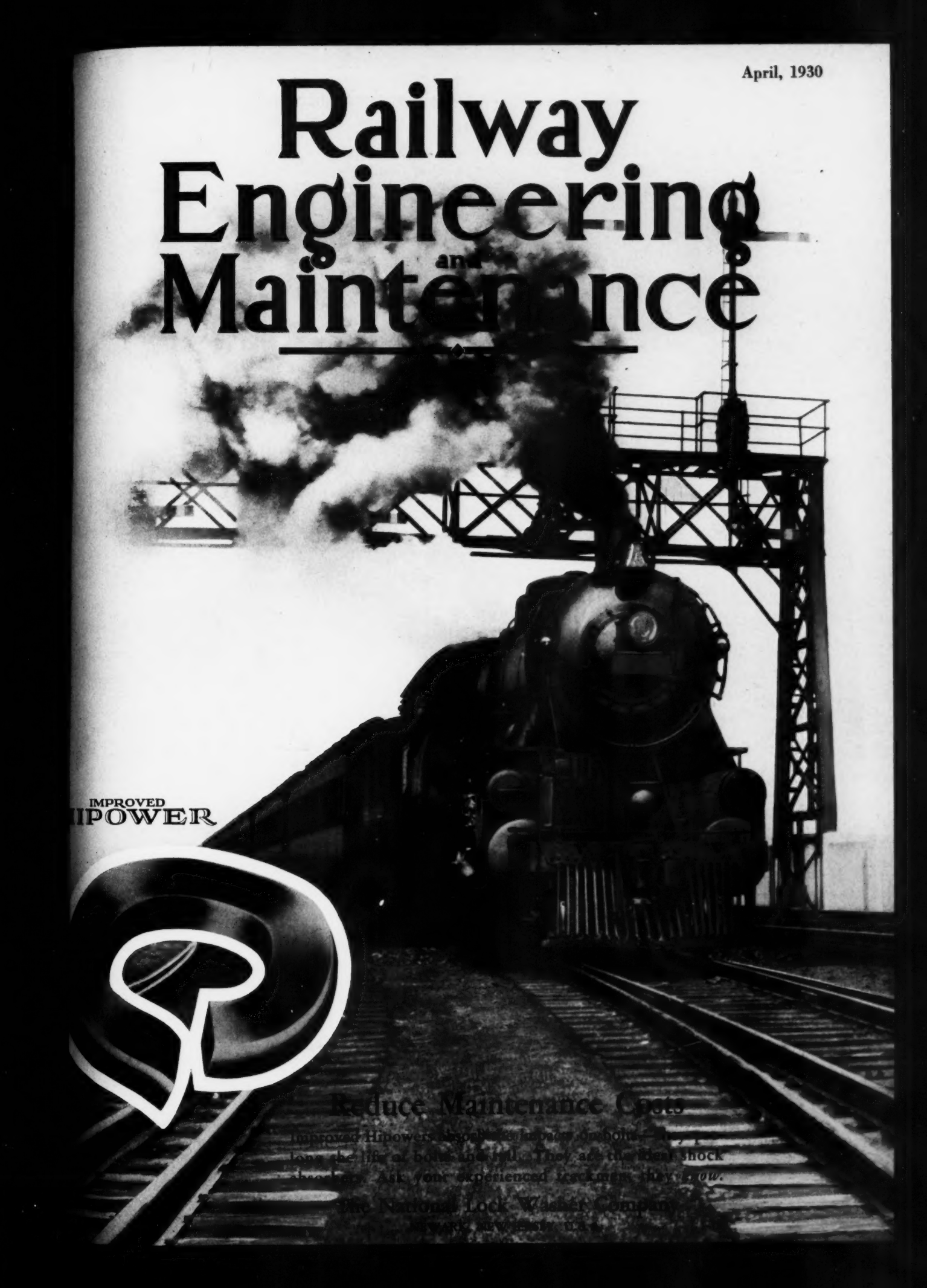
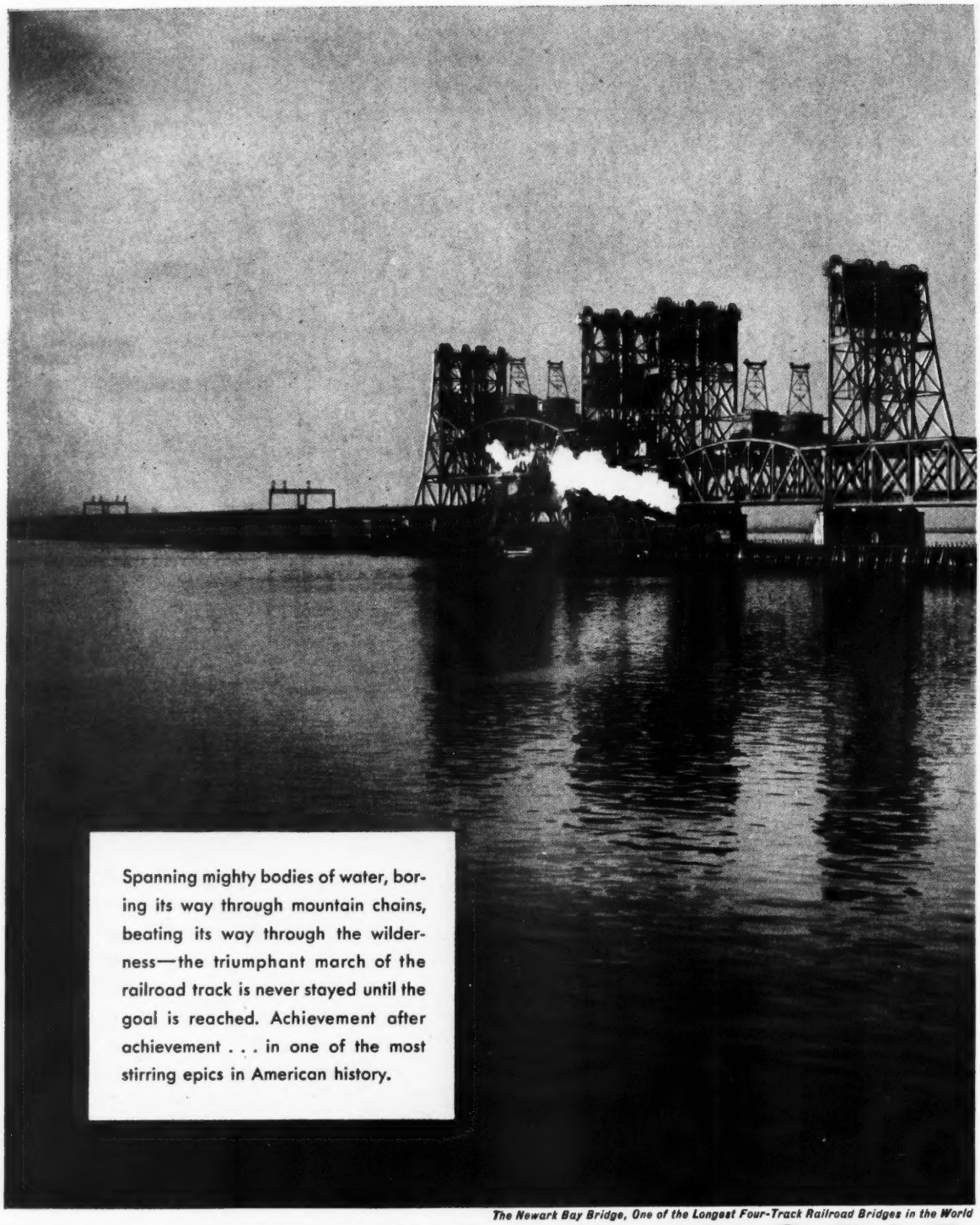
April, 1930

Railway Engineering and Maintenance



RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Publishing Co., at 105 W. Adams St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered as second class matter January 13, 1916, at the postoffice at Chicago, Illinois, under the Act of March 3, 1879.
Alphabetical Index to Advertisers, Page 60 Classified Index to Advertisers, 60-62

ACHIEV



Spanning mighty bodies of water, boring its way through mountain chains, beating its way through the wilderness—the triumphant march of the railroad track is never stayed until the goal is reached. Achievement after achievement . . . in one of the most stirring epics in American history.

The Newark Bay Bridge, One of the Longest Four-Track Railroad Bridges in the World

THE RAILROAD WORLD

EMENT..

A2—Heavy Duty Section Car
6-11 H. P.—Steel Girder Frame
Seats 12 Men

ACHIEVEMENT, no matter how spectacular, is based on knowledge, carefully weighed and patiently applied. In motor cars, for instance, no achievement is so remarkable as this: ***One manufacturer made more than half the motor cars now in service!*** Fairmont.

To be proclaimed Leader in such a highly competitive field is indeed an achievement. But, here, again, knowledge and research were behind it—applied toward the lowering of maintenance costs. That Fairmont engineering has attained this goal and established records of ***Lowest Over-All Cost*** is known throughout the Railroad World. Evidenced by the preference shown above.

For efficiency and economy, put Fairmont Railway Motor Cars to work.

FAIRMONT RAILWAY MOTORS, INC.

FAIRMONT, MINNESOTA, U. S. A.

General Sales Offices: 1356 Railway Exchange Bldg., CHICAGO

District Sales Offices: New York City Washington, D. C. St. Louis San Francisco New Orleans

FAIRMONT RAILWAY MOTORS, Ltd., Toronto, Canada *Foreign Representative:* BALDWIN LOCOMOTIVE WORKS

Manufacturers of section motor cars, inspection motor cars, gang and power cars, weed burners, ballast discers, ball and roller bearing engines, push cars and trailers, roller axle bearings, wheels, axles and safety appliances

Fairmont Mudge

Performance on the Job Counts

KNOWS FAIRMONT

DITCHING *for the* Erie . .

THE Erie R. R. keeps this Northwest constantly at work cleaning out old creek bottoms, digging new ditch along the right-of-way or lead-off ditch from water holes.

When it has completed one job they load it on a standard flat car without dismantling, run it to the next offending stream and it's busy again.

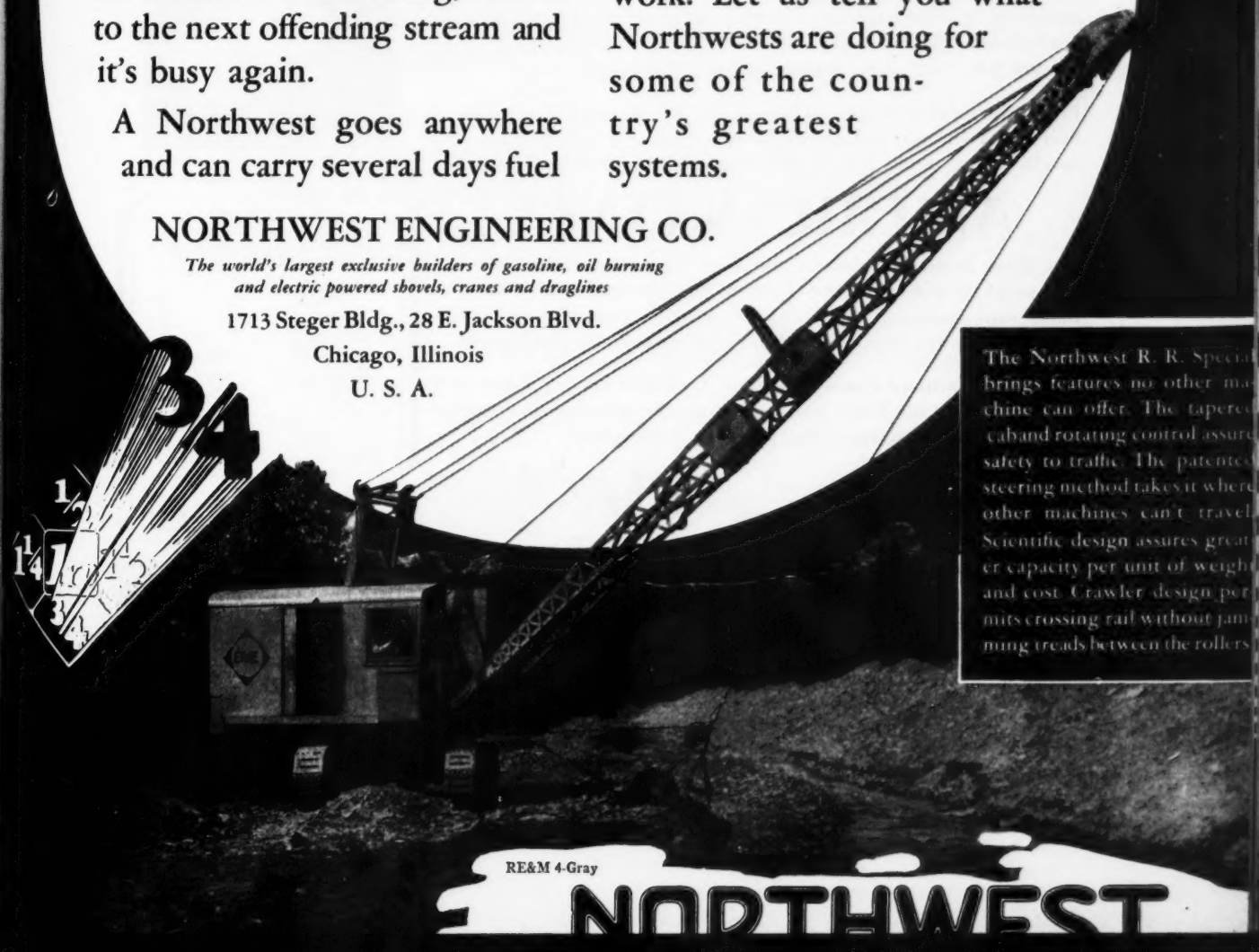
A Northwest goes anywhere and can carry several days fuel with it. It will build out shoulders, handle fill for elevating grade, drive piles, handle rail and do a hundred other jobs along the line. That's why 14 railways are using them.

Let us show you motion pictures of Northwests on railway work. Let us tell you what Northwests are doing for some of the country's greatest systems.

NORTHWEST ENGINEERING CO.

The world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines

1713 Steger Bldg., 28 E. Jackson Blvd.
Chicago, Illinois
U. S. A.



RE&M 4-Gray

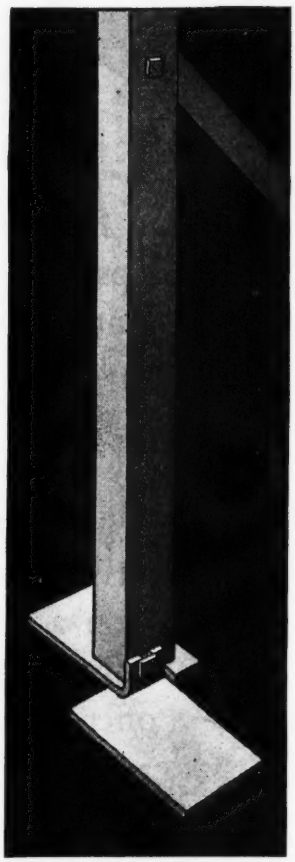
NORTHWEST

Now.. Better Right-of-Way Protection

with

NATIONAL

DIRT SET ANCHOR END and CORNER POSTS



Here is one of the most important improvements ever offered in the science of fence construction for right-of-way protection. Fence posts which combine, in the highest degree, these three vital points of excellence—

STRONGER... *Save Time and work*

They afford the maximum rigidity and resistance against time, weather and every kind of strain. Added to their efficiency in wear is the economy of construction. They are simple and easy to install.

Here is method of setting. Bore a 9-inch hole—drop in post—turn post around using brace as a lever. Anchor plates are thus anchored in solid ground at bottom of post hole. You are now ready to stretch your fence. No delay; just a quick, easy and satisfactory job. And when done it is done "for keeps."

From every point of view of long-time protection and economy, first and last, your maintenance department will find it best to specify the Fencing that is internationally known and used.

AMERICAN FENCE

For there is no question of the need for protection of the life and property bordering the right-of-way. To neglect it is to take dangerous chances. Don't wait for a heavy damage suit which would cost more than the efficient safeguard of a good fence.

American Railroad Fence, National End and Corner Posts and Banner Steel Line Posts meet every specification recommended by the American Railway Engineering Association.

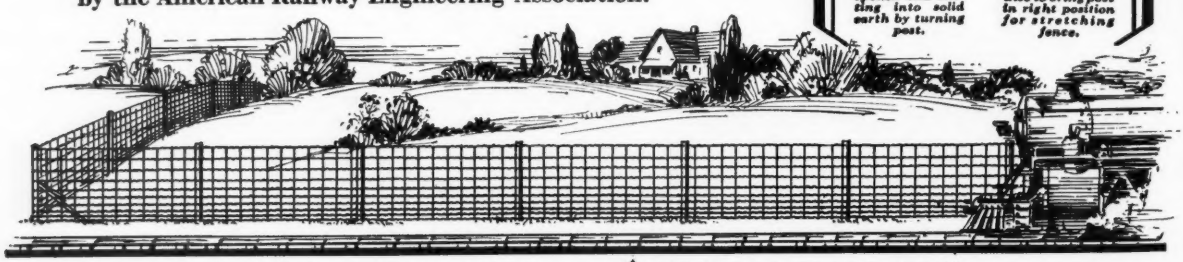
EXPANDING ANCHOR

Size when folded 5" by 7⅝"— diagonally 9½".

Figure 1 Showing folded anchor in bottom of hole, hole 37" deep, 9" wide.

Figure 2 Expanding anchor partly opened and cutting into solid earth by turning post.

Figure 3 Anchor expanded. Post can be turned around as many times as necessary clockwise to bring post in right position for stretching fence.



AMERICAN STEEL & WIRE COMPANY

SUBSIDIARY UNITED STATES STEEL CORPORATION

208 S. La Salle St., Chicago — 30 Church St., New York

Other Sales Offices: Atlanta Baltimore Birmingham Boston Buffalo Cincinnati Cleveland Dallas Denver Detroit Kansas City Memphis Milwaukee Minneapolis-St. Paul Oklahoma City Philadelphia Pittsburgh Salt Lake City St. Louis Wilkes-Barre Worcester

U. S. Steel Products Co.: San Francisco Los Angeles Portland Seattle Honolulu

Export Distributors: United States Steel Products Co., 30 Church St., New York City

Structurally *and* Materially
MOST DURABLE
Says Nature of
ARMCO CULVERTS

Right, An Armco Corrugated Iron Culvert placed under a California railroad in 1908 and in excellent condition today. Below, a 1909 installation in South Carolina which goes on serving continuously and efficiently.

UNDER the railroads—standing the traffic and the severe action of the elements month after month, year after year! . . . that's the kind of test Armco Corrugated Iron Culverts (of purest iron) have stood so exceptionally well for 24 years!

Veterans in service since 1906—serving under all variations of soil, water and other conditions in several latitudes over a broad continent—Armco Nature-tested Culverts offer incontestable proof of the superior durability of pure iron.

The result of Nature's OK is that more than 50,000,000 feet of Armco Culverts have been installed and are in use. Strict adherence to a proved formula of manufacture throughout the 24 years has brought this huge volume of sales, and at the same time has definitely established Armco Culverts as both structurally and materially most durable.

Proof—Nature-tested evidence of Armco superior durability and economy—will be sent on request. Write for new, highly interesting data.

Armco culverts and drains are manufactured from the Armco Ingot Iron of The American Rolling Mill Company and always bear its brand

ARMCO CULVERT MANUFACTURERS ASSOCIATION

Middletown, Ohio

Typewritten Simultaneously in Every one of your Offices

BRANCH OFFICE EXECUTIVE RECEIVES THE MESSAGE AS IT IS TYPED IN HEADQUARTERS

SENDING THE MESSAGE FROM HEADQUARTERS TO THE FIELD

ALL MESSAGES RECEIVED MAY BE PASTED ON LETTER-HEAD SIZE PAPER FOR FILING

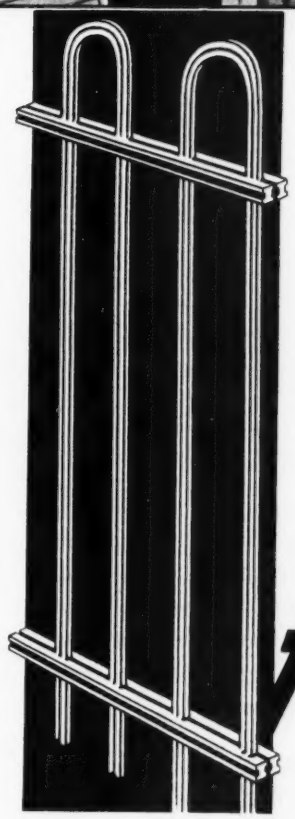
TELEPHONE Typewriter Service speeds modern business by providing instantaneous typewritten communication between the different units of an organization. It weaves together headquarters, factories, branch offices and warehouses almost as closely as though they were under one roof.

A large metal company uses the service to connect its New York office with its mill in West Virginia. Orders, general information, administrative matters, specifications, cost estimates, stock on hand, shipments, etc., are reproduced instantly and accurately at either end. A tobacco company transacts much of the business between its plants in southern states by telephone typewriter. Several hundred messages are exchanged each day.

Telephone Typewriter Service is proving its worth for banks, manufacturing concerns of all kinds, public utilities, government departments, insurance companies, export firms, department stores, travel bureaus. It makes executive control easier and more complete. Facilitates immediate action on vital matters. Transmits important business information while the information is still of value. It is quick, accurate and private.

Would constant, unlimited, two-way written communications be of value to your business? Telephone Typewriter Service can be fitted to your exact requirements. Your local Bell Telephone Business Office will gladly give you complete information.

PERMANENT PROTECTION



Anchor-Weld Intertrack Fences are constructed to give lasting protection. The pickets and rails are inseparably welded together by the exclusive Anchor Electric Flange-Welding Process. Thus, a solid panel is formed--a panel that cannot sag or buckle; or in which the pickets cannot loosen.

Not only does this welded construction provide exceptional strength, but it also results in a fence of attractive appearance, since unsightly braces and other reenforcements are not required.

A phone call to the nearest office will bring a detailed description of the Anchor-Weld Intertrack Fence.

ANCHOR POST FENCE COMPANY
Eastern Avenue and Kane Street
Baltimore, Maryland

Albany Boston Buffalo Charlotte Chicago Cincinnati Cleveland
Detroit Hartford Houston Los Angeles Mineola, L.I. Newark
New York Philadelphia Pittsburgh St. Louis San Francisco Shreveport
Representatives in all principal cities. Consult your local classified directory

ANCHOR FENCES

Beware

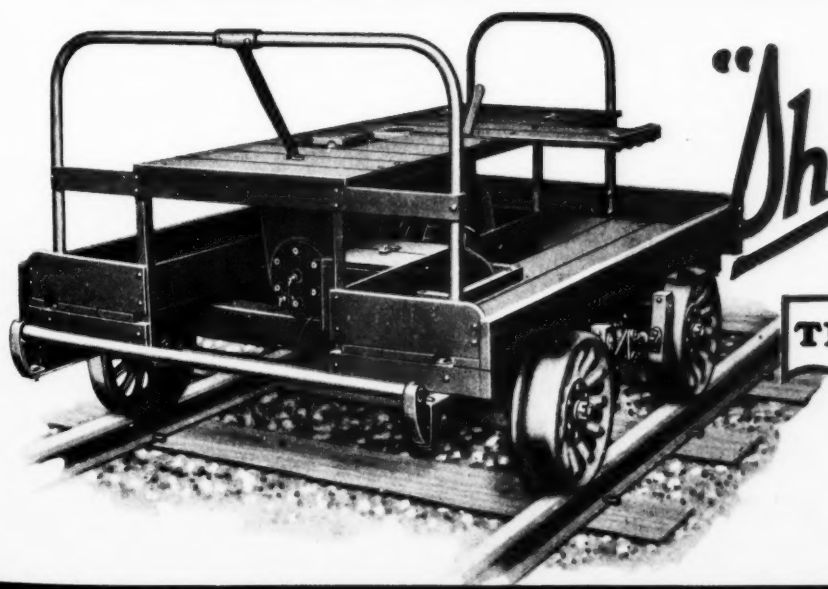
the "*special feature*" sidetrack

1930
begins the
SECOND CENTURY
of building
FAIRBANKS SCALES

Experienced buyers of railway motor cars know that the only way to arrive at motor car value is to stay on the "main line"—to investigate *every part* of the construction thoroughly. Sidetracks—"special features" that may be very desirable in themselves—are sometimes made to look so important that the balance of the construction is taken for granted.

You are not urged to buy a Sheffield Motor Car because of two or three "special features." *Every part* of the "Sheffield" will stand the closest inspection. *Every part* is built to give maximum service. There is no compromise to price. No cheapened construction that needs to be covered up by drawing attention to minor refinements.

Before you buy a railway motor car, gets the facts about "Sheffield." Investigate *every part.* You will then understand why the "Sheffield" is the *lowest over-all cost car on the market.*



"Sheffield"
"44B"

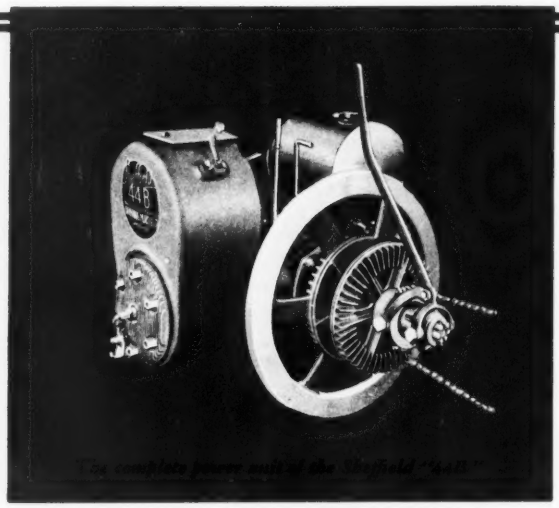
TIMKEN BEARING
EQUIPPED

FAIRBANKS MORSE

MOTOR CARS

F M

Compare the *Sheffield* "44B" Engine with other engines



Motor car dependability rests, first of all, upon the engine. Let's look at the single cylinder power plant that has helped to make the Sheffield "44B" famous for economy and long-life.

Advanced design is apparent at once —as you would expect in the product of an organization that has shown the way in engine building for over 40 years. An efficient, air-cooled cylinder head, in conjunction with water cooling, permits new operating economy. Patented piston design incorporates aluminum alloy head of special shape.

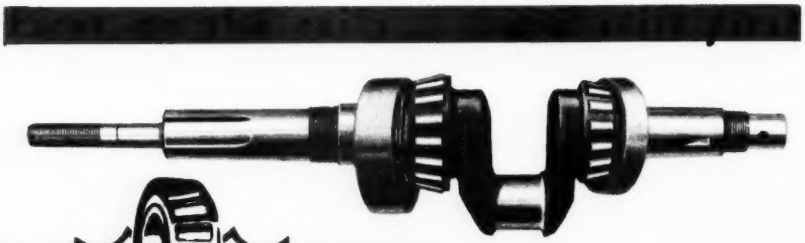
The large crankshaft and the connecting rods are drop forged, heat treated carbon steel. Timken Bearings are used. All parts are precision built and carefully fitted.

If you are interested in improved motor car dependability and in cutting maintenance costs let us send you complete information about Sheffield "44B" construction. *Every part* is important. *Every part* should be investigated *thoroughly.*

1930
begins the SECOND CENTURY of building FAIRBANKS SCALES

FAIRBANKS, MORSE & CO.
900 S. Wabash Ave., CHICAGO

Manufacturers of railway motor cars; hand cars; push cars; velocipedes; standpipes for water and oil; tank fixtures; stationary and marine oil engines; steam, power and centrifugal pumps; scales; motors and generators; complete coaling stations.



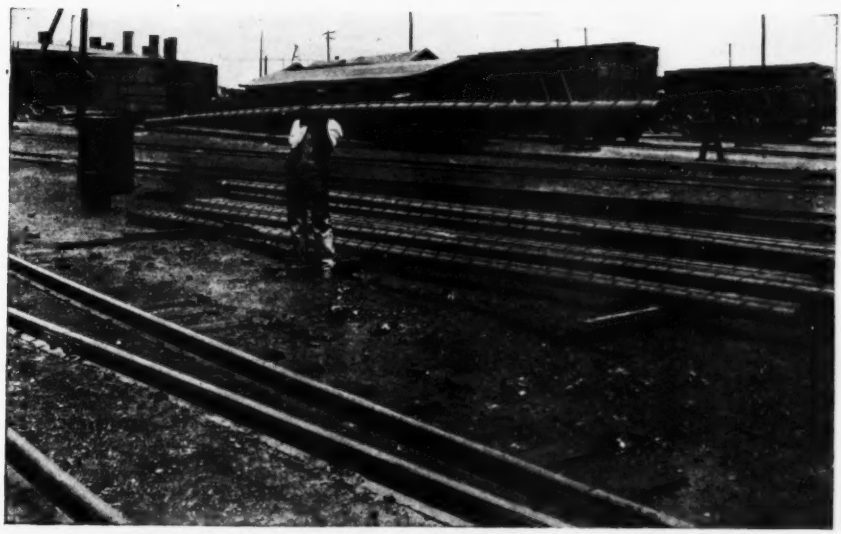
Unusually large crankshaft. Outer races have been moved aside to show the Timken Bearings.

TIMKEN BEARING EQUIPPED

RA21.70

FAIRBANKS-MORSE

MOTOR CARS



Water line of Naylor SPIRALWELD Pipe to be laid between water tank and round house of a prominent mid-western railroad.

A Dependable Low-Cost Water Carrier —Naylor SPIRALWELD Pipe

SPECIAL engineering features of construction give Naylor SPIRALWELD Pipe a dependability and an economy invaluable to the man interested in lowering pipe line costs.

For dependability, Naylor SPIRALWELD Pipe has

...maximum structural strength and positive water-tightness due to its spiralwelded lock-seam truss.

...superior corrosion-resistance due to its Toncan Iron composition.

For economy, Naylor SPIRALWELD Pipe is

...50% lighter in weight than standard weight wrought pipe.

...furnished at no additional cost in uniform lengths of 30 and 40 feet.

Consider these points of pipe difference and use Naylor SPIRALWELD Pipe on your next water line. You will find it costs far less in the ground than does standard weight wrought pipe yet it carries equal pressures. Bulletin 30-1 will be sent on request.

NAYLOR PIPE COMPANY, Main Office & Plant, 1230 E. 92nd St., CHICAGO

SALES OFFICES

25 Church St., New York

Witherspoon Bldg., Philadelphia

1209 First National Bank Bldg., Pittsburgh.

507 Philtower Bldg., Tulsa

601 Post-Dispatch Bldg., Houston

DUCOMMUN CORPORATION
LOS ANGELES SAN FRANCISCO
Exclusive Distributors:
California, Arizona, Nevada and Utah

MONTREAL, CANADA
Mechanical Equipment Co.,
New Birks Building

TONCAN COPPER

Naylor Pipe

Maximum Structural Strength Mo-lyb-den-um With Minimum Weight

IRON

Standardized Naylor Pipe is made in sizes 6" to 12" I. D. and 14" to 20" O. D. in any uniform length desired up to 40' 0". Ends made to wrought pipe standards for all types of coupling.

Where corrosion is not a problem, Naylor Pipe can be furnished in steel.

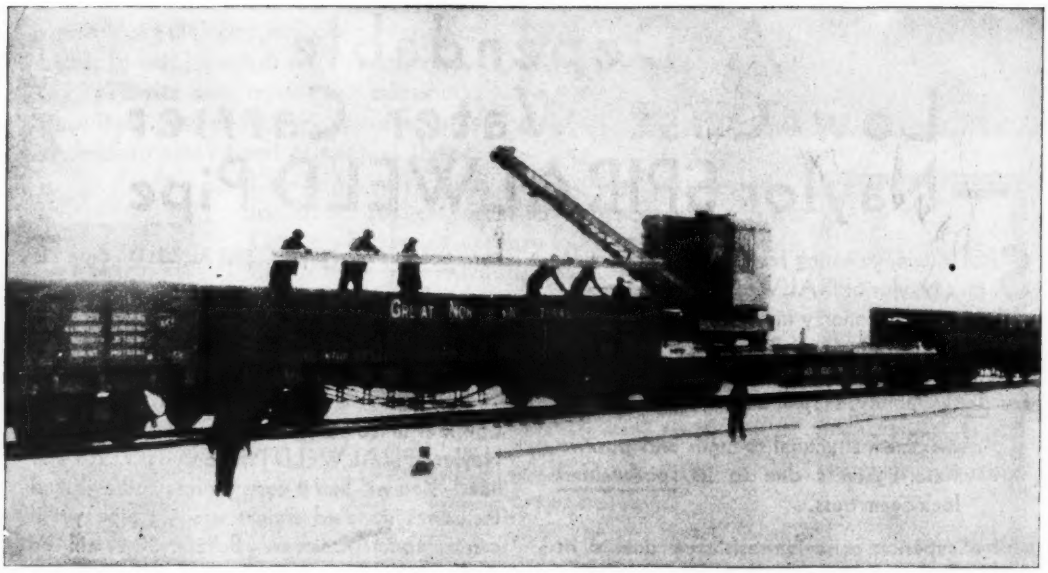
Toncan Copper Molybdenum Iron is a development of Central Alloy Steel Corporation, the world's largest and most highly specialized alloy steel producers. It possesses a superior corrosion resistance, making it the favored pipe material.

Model 20

BURRO CRANE

Model 30

Low Overall Height *Is Economy*



Standard Burro Crane on a flat car in a work train distributing new rail. The Burro is mounted on rails so it can travel back and forth and can work from any part of the car.

Burro Features

Utility
Long Reach
Low Overall Height
Travel Speeds
1½ to 20 miles per hour
Draw-Bar Pull
6000 to 7000 lbs.
Rated Capacities
Model 20 . . . . 11,000 lbs.
Model 30 . . . . 14,700 lbs.

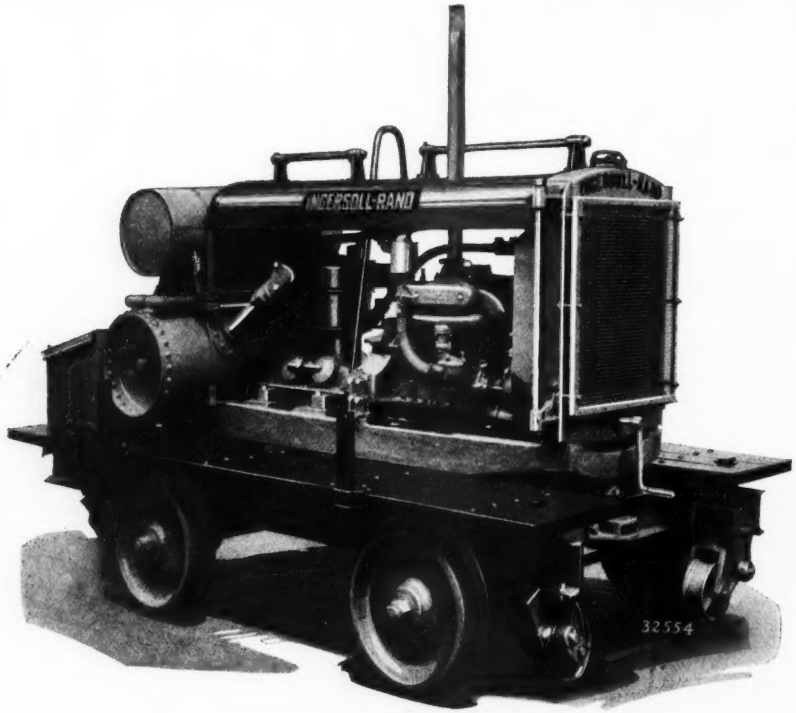
Burro Crane low overall height, only 11'-0", gives the Burro a wider range of operation. This is due to the fact that the standard crane can be operated on a car in a work train, as well as on standard gauge track.

Loading and unloading the Burro is easily accomplished by running the crane up or down an incline composed of two 33' or two 39' rails. The crane has ample power to propel itself up this incline.

This flexibility of operation means increased uses for the Burro, together with the elimination of idle periods, resulting in greater return from the investment.

Cullen-Friestedt Company, 1300 South Kilbourn Avenue, Chicago

Pneumatic Tie Tamping Outfits



Size 5½" x 5" Compressor. The air aftercooler, solid wheels, hand rails, and platform stakes are among the visible improvements.

Thousands of hours of service built these machines

Again Ingersoll-Rand Tie Tamper Compressors embody numerous improvements and refinements over previous designs. This is in keeping with Ingersoll-Rand's policy of constant development and improvement so that users will obtain still greater value from their investment.

Included in these units are the results of thousands of hours of service on the country's most important railroads. Working closely with railroad organizations throughout the country, Ingersoll-Rand Engineers are ever on the alert to make these units still better in efficiency and all around serviceability.

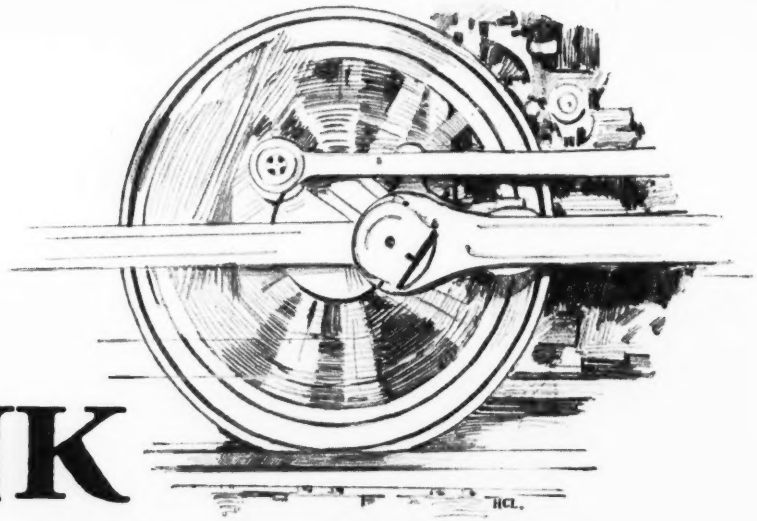
INGERSOLL-RAND COMPANY - 11 Broadway - New York City

Branches or distributors in principal cities the world over

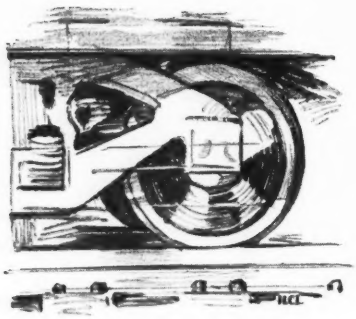
For Canada Refer—Canadian Ingersoll-Rand Co., Limited, 10 Phillips Square, Montreal, Quebec

276-TT

Ingersoll-Rand



CLANK CLANK CLANK BANG BANG



EVERY day—every minute—every time a wheel turns—destruction plays havoc with your track.

Wheels that bring you revenue also raise your maintenance costs.

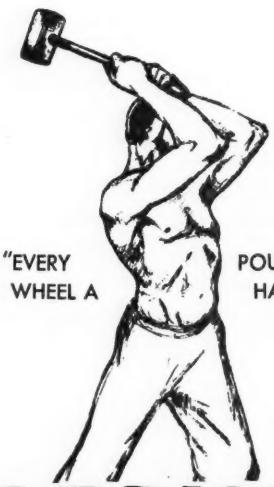
To combat the increasing cost of upkeep, Morrison offers you four unusual services—four methods of reducing costs—four plans that have been approved and are being used by some of America's greatest roads.

CROPPING

Rails with worn and broken ends—with underhead wear from loose splice bars—are shipped to any of the strategically located Morrison plants. There they are cropped, redrilled, straightened, classified for vertical wear and returned ready for use. Quantity production permits extremely low costs and rapid service.

REBUILDING FROGS

Your old, worn frogs, manganese or carbon, are rebuilt through our special welding process for service as good as new at one-third the cost.



"EVERY WHEEL A POUNDING HAMMER"

RENEWING SWITCH POINTS

Don't discard worn switch points! Morrison (patented) Renewing process returns them to you made like new, look like new, and worth as much as new in service, at one-third their original cost.

MAINTAINING CROSSINGS

Crossings are costly to replace, both in material and labor. Why permit them to batter and wear when Morrison Crossing Maintenance Service is at your disposal? Let us tell you about it.

SALES OFFICES
BUFFALO, 31 Morrison Building
CHICAGO, 332 So. Michigan Blvd.

"DEVOTED TO ECONOMIES

MORRISON
RAILWAY SUPPLY CORP.

IN TRACK MAINTENANCE"

PLANTS AT
BUFFALO—CHICAGO—VERONA, PA.
INDIANAPOLIS—MARYSVILLE, PA.

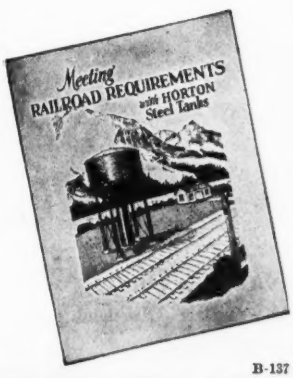
For water station improvements . . use STEEL tanks

Elevated steel tanks are available in the large sizes necessary to take care of increased water demands. Their use is in line with the lengthening of distance between water stations and present day large tender capacities.

The installation of well-proportioned, long-lived steel tanks is also in line with present day operating economy as practiced by railroads.

The only maintenance required to keep them in good condition is a coat of paint every few years. Seldom is it necessary to make extensive repairs or replace parts of the structure.

Ask our nearest office for a copy of the booklet entitled Meeting Railroad requirements with Horton Steel Tanks. It gives detailed information about the conical-bottom and ellipsoidal-bottom types.



B-137

CHICAGO BRIDGE & IRON WORKS

Chicago.....2452 Old Colony Bldg.
New York..3156 Hudson Term. Bldg.
Cleveland.....2202 Union Trust Bldg.
Dallas.....3309 Magnolia Bldg.
Birmingham.....1546 50th Street, N.
Detroit.....1519 Lafayette Bldg.
Philadelphia.....1609 Jefferson Bldg.
Atlanta.....1036 Healey Bldg.
San Francisco.....1007 Rialto Bldg.
Boston....1522 Consolidated Gas Bldg.

HORTON TANKS

Announcing

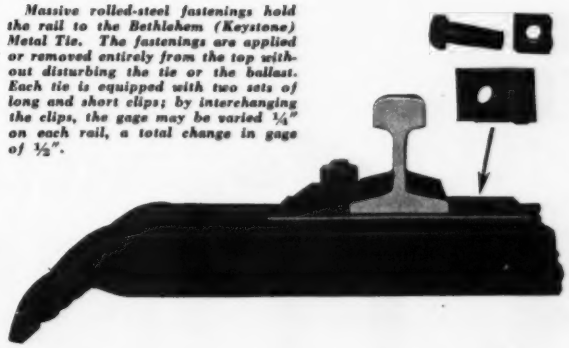
A *new* Metal Tie

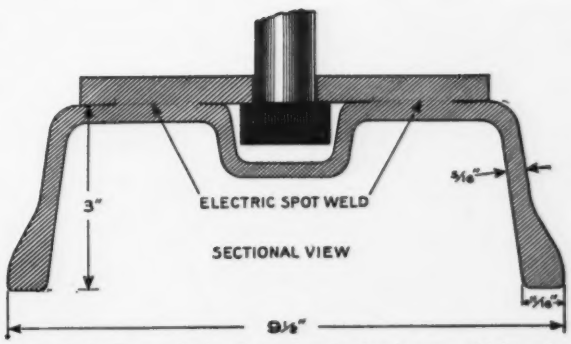
for reinforcing wood-tie track

The new Bethlehem (Keystone) Metal Tie No. 17 is used to reinforce wood-tie track. Substituted for every third or fourth wood tie. These metal ties carry the full strain of the rail fastenings, add years to the life of the wood ties and hold the track true to gage and in alignment. On curves and steep grades Bethlehem (Keystone) Metal Ties may be used as stiffeners and to replace gage rods. They prevent spreading or rolling over of the rails, thus reducing the possibility of derailment.

The Bethlehem (Keystone) Metal Tie has a much longer life than wood ties and considerably reduces tie renewals. Bethlehem (Keystone) Metal Ties do not become spike-killed or cracked and will not burn out. Use them in sidings, yards, cinder dumps, round houses, and at water tanks and other locations where wood ties have comparatively short life.

Massive rolled-steel fastenings hold the rail to the Bethlehem (Keystone) Metal Tie. The fastenings are applied or removed entirely from the top without disturbing the tie or the ballast. Each tie is equipped with two sets of long and short clips; by interchanging the clips, the gage may be varied ¼" on each rail, a total change in gage of ½".





Each of the Heavy rolled-steel tie plates is electric spot welded to the tie in four places, reinforcing the tie beneath the rails.

BETHLEHEM STEEL COMPANY

General Offices: Bethlehem, Pa.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Detroit, Cincinnati, Chicago, St. Louis.

Pacific Coast Distributor: Pacific Coast Steel Corporation, San Francisco, Los Angeles, Portland, Seattle, Honolulu.

Export Distributor: Bethlehem Steel Export Corporation, 25 Broadway, New York City.

BETHLEHEM

Keystone Metal Tie No. 17

Increasing Rail Weights Demand A Better Road-bed

FROM 100-lb. up to 130-lb. and even higher has gone the weight of rail.

This calls for better road-bed; better drainage. Water-soaked soil cannot be permitted to serve as a foundation for modern track. Lead off the water with drains and culverts of Toncan Iron.

These corrugated metal drains have the flexibility necessary to meet the increasing strain on the track structure.

Then, too, culverts of Toncan Iron have permanency as well as structural superiority.

Corrosion was once the corrugated culvert's worst enemy, but now that has been checked by using Toncan Iron.

To iron that has been thoroughly refined are added copper and molybdenum. These two elements alloy with the iron and impart a corrosion resistance that has never been reached before.

Thus Toncan Iron is particularly fitted for the permanence which is so necessary in culverts. Yet Toncan costs no more.

TONCAN CULVERT MANUFACTURERS' ASSOCIATION, MASSILLON, OHIO

Plants located in all Parts of United States and Canada.

REG. U. S. PAT. OFF.

TONCAN

PLANT A FENCE
AND RAISE YOUR PROFITS

Calvert
Coal Company
Elkhart, Ind.

Install real protection~ stop these preventable losses

1. **Stop pilfering of tools, materials and supplies.**
2. **Stop personal damage claims.**
3. **Stop coal pile borrowing.**
4. **Stop fire hazards.**
5. **Stop trade information leaks.**
6. **Stop interference from outsiders—enforce "no trespassing"—one way in or out.**

Positive protection is of real value in modern operation. You can turn these losses into profits with Page Fence—make executive supervision easier—increase the fixed value of grounds and buildings.

INVESTIGATE!
Page fabric available in Copperweld non-rusting wire — reduced upkeep — lifetime service.

Page Fence stops interference from outsiders—workmen are kept "on the job"—work goes through as scheduled. Yard space becomes safe for storage and watchmen are frequently no longer needed. These savings alone will pay for a fence in a very short time.

America's first wire fence since 1883

PAGE STEEL AND WIRE QUALITY PRODUCTS

nation-wide service through 64 service plants

PAGE FENCE

CHAIN LINK · GALVANIZED OR COPPERWELD · ORNAMENTAL WROUGHT IRON

America's first – since STEEL AND WIRE PAGE QUALITY PRODUCTS *wire fence* 1883

Near You

an expert orqanization offers you better fence protection

RIGHT in your vicinity is a PAGE Fence Service Plant ready to help you—from first plans to final erection. The reputation and future of this Service Plant depend upon your satisfaction—upon the service they give you and other fence prospects in your community. They are interested in your satisfaction permanently—throughout the life of the installation. They know that you, as a satisfied customer, are the best advertisement they can have for their business.

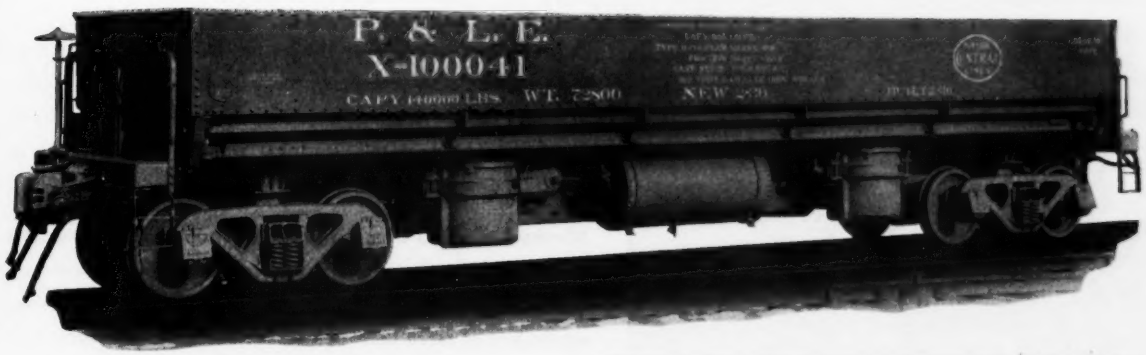
It will pay anyone interested in better property protection to get in touch with these experts in your community. Write today for name and address of company in your territory. No obligation. Page Fence Association, Dept. (B32), 520 N. Michigan Ave., Chicago, Ill.

INVESTIGATE! *Page fabric available in Copperweld non-rusting wire—reduced upkeep—lifetime service.*

PAGE FENCE

CHAIN LINK - GALVANIZED OR COPPERWELD - ORNAMENTAL WROUGHT IRO

A COMMANDING ACHIEVEMENT



35 cu. yds.—70 ton capacity
Built for P. & L. E. R. R.

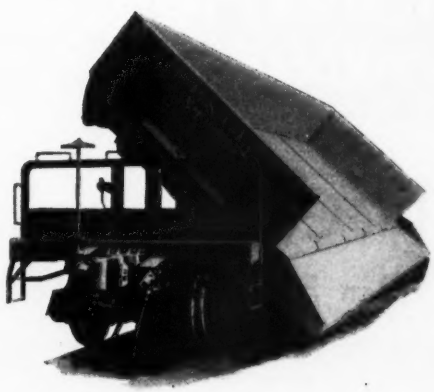
THE KOPPEL AIR DUMP CAR

Rolling Trunnion Type

Time Saving
Labor Saving
KOPPEL
Safe and Serviceable

Koppel's long experience in building and designing many of industry's most successful cars is concentrated into the design and construction of this strong, rugged, all-steel air dump car.

A quick, clean, dumping action is assured by the unique design of the doors which automatically turn out and down as the car body is elevated into the dumping position.



KOPPEL INDUSTRIAL CAR & EQUIPMENT CO.

NEW YORK
CHICAGO

KOPPEL, PA.

SAN FRANCISCO
PITTSBURGH

No. 16 of a series

PUBLISHER OF
RAILWAY AGE
RAILWAY MECHANICAL ENGINEER
RAILWAY ENGINEERING AND MAINTENANCE
RAILWAY ELECTRICAL ENGINEER
RAILWAY SIGNALING
MARINE ENGINEERING AND SHIPPING AGE
THE BOILER MAKER

Railway Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING COMPANY

"THE HOUSE OF TRANSPORTATION"

PUBLISHER OF
LOCOMOTIVE CYCLOPEDIA
CAR BUILDERS' CYCLOPEDIA
RAILWAY ENGINEERING AND MAINTENANCE CYCLOPEDIA
BOOKS ON TRANSPORTATION SUBJECTS

NEW YORK 30 CHURCH STREET | CHICAGO 105 WEST ADAMS ST. | CLEVELAND 50 PUBLIC SQUARE | WASHINGTON 17TH AND H STS. N.W. | SAN FRANCISCO 215 MARKET STREET

ADDRESS REPLY TO
105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: BRIDGING THE GAP

Dear Reader
Everywhere:

March 27, 1930.

"Some years ago your suggestions and assistance in the preparation of short replies to questions published in the What's the Answer department of Railway Engineering and Maintenance singled me out of the milling mass of maintenance of way employees and brought my name before our general officers. This was my first real boost up the ladder of success and did more to start me on the way to promotion than you will ever appreciate."

This extract from a letter written to his superior officer by a man who was recently promoted from track foreman to roadmaster deals with a problem which is confronting many a man. In these days of large organizations, the man on the job is so far removed from the head of his department that there is a possibility of his being overlooked when a vacancy occurs. Every ambitious man is striving to attract the attention of the man above him to avoid such a misfortune. The man quoted above discovered a way to bridge this gap.

The problem of the indivdual today is to sell his services to the best possible advantage. This can be done only if he creates a demand for these services. To do this he must bring his knowledge and his talents before his superior officers or other possible employers in the most favorable light. The printed page in a publication such as Railway Engineering and Maintenance offers such an opportunity. In making this statement I do not desire to infer that we are short of "copy" or that we can use all articles which are submitted to us, for the fact is that we are forced to return more articles than we are able to accept.

The former track foreman from whose letter I have quoted is one of a considerable number of railway men who have profited by directing attention to themselves through the preparation of instructive articles on timely maintenance of way topics for publication in our columns. This is one way whereby an individual may break through the barrier imposed on him by our modern industrial life.

Yours truly,

ETH*MM

Elmer T. Howson

Editor.

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

Part of a vast retaining wall project for a leading railroad. Engineers have been quick to perceive the extra value in Federal.

Compare This Retaining Wall For Stability—Beauty—*Economy!*

Note the Y-shaped headers which interlock with the stretchers, holding the backfill without the use of a third member in the bank. This results in a cellular wall of great strength and with no plane of cleavage.

If you are laying out *any* retaining wall for Spring construction, it will pay you to compare this modern 2-piece design with all other forms—poured or crib wall.

The unique Federal interlocking feature produces a strong, stable wall. There are only *two units* to handle—no forms, stripping or rubbing face—no expensive foundations. The savings in material and labor to erect are tangible and substantial.

Once up, the wall is one to be proud of—striking, closed-face beauty—without maintenance. Federal may be quickly erected in any weather—offers complete salvage on relocation.

Why not permit our engineers to submit data on our construction, for your comparison? Catalog on request.

FEDERAL CEMENT TILE COMPANY, 608 South Dearborn Street, Chicago, Illinois

Concrete Products *for Over 25 Years*

FEDERAL 2 piece Concrete CRIBBING

ELMER T. HOWSON, *Editor*
WALTER S. LACHER, *Managing Editor*
NEAL D. HOWARD, *Eastern Editor*
GEORGE E. BOYD, *Associate Editor*

Railway Engineering and Maintenance

F. C. KOCH, *Business Manager*
H. F. LANE, *Washington Editor*
M. H. DICK, *Associate Editor*

Name Registered U. S. Patent Office
Formerly the Railway Maintenance Engineer
Published on the last Thursday preceding the month of issue by the
Simmons-Boardman Publishing Company
105 West Adams Street, Chicago

CONTENTS FOR APRIL, 1930

SIMMONS-BOARDMAN PUBLISHING COMPANY, Edward A. Simmons, *President;* L. B. Sherman, *Vice-President;* Henry Lee, *Vice-President;* Samuel O. Dunn, *Vice-President;* C. R. Mills, *Vice-President;* F. H. Thompson, *Vice-President;* Roy V. Wright, *Secretary;* and John T. DeMott, *Treasurer.*

Subscription price in the United States, Canada and Mexico, $2.00 per year; foreign countries $3.00. Single copies, 35 cents.

New York: 30 Church Street
Chicago: 105 W. Adams Street
Cleveland: Terminal Tower
Washington, D. C.: 17 and H Streets N. W.
San Francisco: 215 Market Street

Publishers also of
Railway Age — Railway Mechanical Engineer
Railway Signaling — Airway Age
Railway Electrical Engineer — The Boilermaker
Marine Engineering and Shipping Age
Railway Engineering and Maintenance Cyclopedia
Car Builder's Cyclopedia — Locomotive Cyclopedia
American Builder — House Furnishing Review

Member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulations (A. B. C.).

Request for change of address should reach us two weeks before the date of the issue with which it is to go into effect. In sending us change of address please be sure to send us your old address as well as the new one.

Entered at the postoffice at Chicago, Ill., as mail matter of the second class.

Railway Engineering and Maintenance

Volume 26 April, 1930 No. 4

Get an Early Start

THERE IS a tendency in business at the present time to postpone commitments for improvements, even though it may be known definitely that they must be made during the season. If this tendency were confined to a single industry the effect would not be of much concern, but it prevails very generally and is not without evidence among the railways. The roads advised President Hoover last November that their programs of capital expenditures this year would exceed those of 1929 by 25 per cent. The large rail orders that they placed about the same time indicated equally liberal maintenance programs. There is no reason to believe that the managements of the roads contemplate any change in the attitude which they expressed at that time. In some quarters, however, there is a tendency to so delay preparations for the inauguration of their programs as to threaten difficulty later in the season and otherwise add to the cost.

Practically all railway and other business leaders are in agreement in the belief that the early summer will see a rapid increase in activity. With this will come a larger demand for labor and for materials, with their resulting effect on costs. The railways do not need to look beyond their own records for proof of this latter fact for it is not many years since it was the widespread practice to hold back all possible expenditures until July 1 and then attempt to crowd seven or eight months work into four, at a time when every other industry was likewise going at high speed. No maintenance man who recalls these experiences desires to repeat them. Yet this is a possibility that confronts those who delay the inauguration of their programs this year. The one sure way to play safe as to completion as well as to the cost of work is to start early at least that portion of the program that must, of necessity, be done this year. By so doing, the roads can not only conserve their own interests, but can also do more to revive business activity than by crowding programs into what may be an over-busy fall.

Capital Expenditures in 1929

Capital expenditures of the Class I railways in 1929 totaled $853,721,000, a figure that has been exceeded in only three previous years—1923, 1924 and 1926, and that compares with $676,665,000 in 1928 and with a 10-year average of $750,868,000. Furthermore, the unexpended authorizations carried over into 1930 amounted to $183,908,000 for equipment and $440,402,000 for roadway and structures, or $624,310,000, which represents the largest amount of uncompleted work ever carried over from one year into another.

The amount devoted to the purchase of equipment in 1929 was $321,306,000, while $532,415,000 was expended for extensions and improvements to the fixed properties. The latter expenditures included $129,148,000 for additional tracks, $46,862,000 for heavier rail, $36,561,000 for shops and engine houses, $17,049,000 for ballast, and $302,795,000 for other improvements. The authorizations carried over, together with the estimated authorizations for additional work, indicate that the Class I railways of the United States alone will spend $1,050,000,000 in 1930, and those in Canada and Mexico proportionately.

Improving the Quality of Ties

THE American Railway Engineering Association adopted specifications for ties in 1921 and revised them slightly in 1926, in the light of five years' experience in their application. Shortly after the 1926 convention, they were approved by the American Railway Association and sent to the member roads with the recommendation that they adhere to them fully in purchase, storage and use. These specifications marked a distinct advance in the formulation of requirements for ties and they have since been very generally accepted by both the railways and tie producers.

During 1925, the Tie committee of the A.R.E.A. made an inspection of approximately 3,000,000 ties which had been accepted by various railways for use. The committee reported that, while ties fully meeting the specifications were being made in large numbers and that all of the ties needed could be secured in accordance with the requirements of the specifications, many of the railways were overgrading their ties, some were accepting decayed ties and others were allowing sound ties to decay while seasoning under improper conditions.

Similar inspections have since been made annually in different sections of the country and the committee reported at the recent A.R.E.A. convention that, although it found that the inspection is not as lax as formerly, many of the 800,000 ties it examined in 1929 were overgraded and that it found a large number of oversize ties which had been accepted as though they were of normal dimensions. Furthermore, poor manufacture was evident, as ties that were poorly hewed, crooked and bowed and unpeeled ties were found, all of which showed a disregard for standards.

There was an evident improvement in the condition of the storage yards, but in some instances decay was conspicuous in the storage piles. Some of this was the result of poor piling, but some of the ties had been held too long in storage and others had incipient decay when brought into the storage yard.

In view of the fact that ties constitute one of the major items of railway costs, it is difficult to understand why so many responsible officers remain indifferent to the losses which these lax methods of inspection entail and to the further losses which result from carelessness in the storage and turnover of the tie stock. On many roads these unfortunate features of tie purchases and storage could be eliminated with little effort, if system officers would impress on the men in the field the fact that lax methods of inspecting and of handling ties would not be tolerated.

Are You Sympathetic?

THERE IS an increasing tendency in American industry for the employer to assume a considerable degree of responsibility for the well-being of his employees. This is prompted by motives that are not entirely unselfish; safety activities, for example, benefit the employer because they result in reduced personal injury claims. But much that is done under the heading of welfare work, if handled tactfully and without undue interference with the private affairs of the individual, has its greatest return through improved morale—a more sympathetic attitude toward the company.

What the individual foreman or supervisor may do in the way of welfare work depends in large measure on the policy of the management. Nevertheless, there are measures that he may take as an individual that will be of value to his men and be of benefit to him also through an improvement in his relations with his men. The fact that his railway does not maintain an effective system of physical examinations, or some system of health service, does not prevent him from taking an active interest in the health of his men. He can inquire as to their health, and watch for evidences of ill health and, when his judgment indicates, can suggest a visit to a doctor. Obviously, this will not serve the place of periodic physical examinations of all employees, since such examinations often disclose grave conditions unknown even to the person examined, but in the absence of such health service, it will prove of some benefit to the man who needs sympathetic guidance and will certainly create a better understanding between the men and those who supervise their work.

Can the Open-Deck Pile Trestle Be Improved?

THE open-deck pile trestle is the oldest form of bridge structure employed to carry railway tracks. In general outline, the trestle today is but a stronger counterpart of the structure of 100 years ago. But from the standpoint of details, it represents the result of considerable refinement. Corbels have been eliminated, piles are no longer tennoned into the caps; in a word, it is a better structure built with far less expenditure for labor than was required in the pioneer structures.

Considering the length of the period during which these changes have taken place, it would naturally be assumed that there is little likelihood of any further deviation from the prevailing design; in fact, this is the consensus of railway bridge men. However, a monograph embodied in the report of the Committee on Wooden Bridges and Trestles, presented before the recent convention of the A.R.E.A. suggests possibilities for a number of changes. A few of these, mentioned by way of suggestion are as follows: Inside metal guard rails and tie spacers in place of outside guard timbers; eight-foot ties in place of ten-foot ties; close packing of chords; two-piece caps with a hardwood under cap to resist bearing failure and a 16-in. upper cap to provide greater stringer bearing area; chord lining instead of tie lining; and the use of concrete for mud sills or bank blocks and for fire protection of stringers between ties and for caps between chords.

It is to be expected that these suggestions will receive rather widespread criticism, much of it founded on thoroughly valid objections. They should show, however, that there is still opportunity for a thorough study of the open-deck trestle with a view to further improvement. Some of the proposals imply the use of treated timber, a requirement that will be imposed eventually if the open-deck trestle is to retain its economic justification.

More and Better Drainage

"WATER is the greatest enemy of track." This statement has appeared so universally in every treatise on track maintenance that it has become a platitude. It is recognized by every experienced maintenance of way officer as a cardinal principle in track work. Yet it is so fundamental that it cannot be overemphasized.

While the problem of track drainage is as old as the track itself, it is constantly taking on new characteristics. The heavier wheel loads and the greater depths of ballast have made obsolete many of the methods which sufficed a few years ago. The larger locomotives have driven the ballast with its water pockets below the levels of existing lines of drainage, if they have not pushed them so far out of line or crushed them to such an extent as to make them largely, if not entirely ineffective. As a result, a roadmaster is now often confronted with drainage problems at points where he has long felt secure in the belief that he was free from trouble.

The frequency with which trouble is developing at points heretofore free from difficulty, shows the necessity for a new and more thorough approach to the problem from the standpoint of present-day traffic requirements and standards of roadway construction, regardless of present practices. Furthermore, it is no longer sufficient to drain a single cut here and there as conditions become sufficiently acute to require attention; rather the problem is to attack an entire district or division as a unit in the same way that a ballasting program is devised and bring the entire territory to the same general standard as regards drainage. No one would think of ballasting a cut here and there. It is equally slipshod to drain intermittently.

Again, the character of the drainage that is warranted or demanded on different territories differs just as widely with traffic and other conditions as does the standard of ballasting. It costs money to install adequate drainage. This money must, therefore, be spent most wisely in order to get the maximum return. There is no more economy in putting in light or shallow drains on a line carrying heavy loads than there is in placing cinder ballast where crushed stone should be used.

Recognition of the changing requirements of traffic is leading many roads to drain their track more universally, to move the drainage lines further from the track in order to escape the distortion of the earth under heavy loads and to lay the drains deep enough to get them below the water pockets that form under modern traffic. It is also leading numerous roads to resort to longer and stronger metal pipe in place of the clay tile

that was once so generally employed, as evidenced by the fact that one road placed a single order for 35 miles of such pipe last year and another for 18 miles.

The subject of drainage is of special importance at this season of the year when working programs are being made and funds allotted. There are few expenditures that yield larger returns on a road than those for drainage. In many cases adequate drainage is essential, if other expenditures are to yield the maximum return. No matter what the character of its construction may be, no section of heavy traffic track can be considered to be completed today until it is adequately drained.

In the Good Old Days

MAINTENANCE-OF-WAY officers are not always satisfied with the character and quality of the materials that are provided for their use, and there are, undoubtedly, some officers who would welcome the opportunity to exercise a far greater degree of authority in their selection than they now possess. In this connection, it is of interest to recall that there was a time when many roadmasters enjoyed rather extended prerogatives in the purchase of supplies. Railroad systems were then much smaller than they are today, the departmental lines were not so closely drawn and the roadmaster, with the counsel of his superintendent, enjoyed rather broad powers in the selection of much of the material he used, particularly the tools and the more special items of track supplies.

But this state of affairs was not without its disadvantages. Standardization had a meaning only to students of the dictionary—it had no significance in railroad parlance. For, while the roadmaster was given to the expression of his own ideas when ordering materials, he was also compelled to take into account the preferences of his section foremen. Pick handles, for example, were sometimes ordered in several different lengths because one foreman wanted one length and another insisted on something else. The convention of the New England Roadmasters' Association in 1886 was unable to agree on the standard weights of spike mauls, because several members insisted that it was necessary to supply both eight-pound and ten-pound hammers to satisfy the preferences of the trackmen.

Lack of standardization and the absence of well-defined specifications were reflected also in the quality and primary dimensions of the materials furnished. Thus, at the same convention, several members reported that they invariably passed new rails through a jim crow, as they were not straight enough as delivered to be laid directly in the track. But even greater difficulties were encountered by reason of the fact that such details as the drilling of rails was not thoroughly defined, with the result that splice bars used with one consignment of rails would not fit the holes drilled in rails of the same pattern purchased on a subsequent order.

Broad authority and the exercise of individual initiative and preferences were essential to the successful construction of railways in pioneer days. The very absence of precedents and recommended standards made individual initiative in such matters all the more essential. But while this was so necessary for success in pioneer days, it militated against efficiency in the operation of established railway properties. It was the need for standardization in practice and materials which led to the organization of the various associations of maintenance-of-way officers, and it has been through the establishment of standards, with the limitations they place on individual preference, that the railways have been able to benefit to the fullest extent from the work of associations.

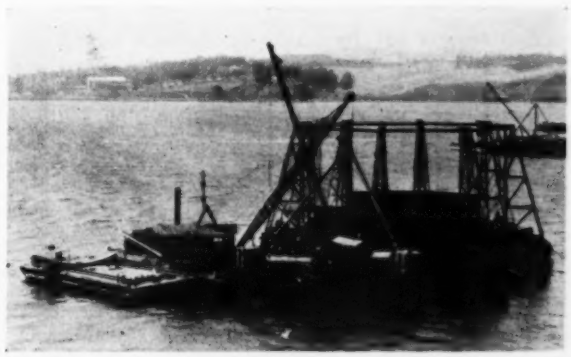
Assets or Liabilities?

NOT A FEW roads find it necessary to provide houses for their track forces at outlying points in order that these forces may be assured of adequate living accommodations. Such facilities are not infrequently regarded as a necessary burden, the expense of which should be held to the minimum. On the contrary several roads convert this necessity into an asset by utilizing it as a means of building up a force of permanent, contented employees. One such road is the Southern Pacific Lines in Louisiana and Texas.

On this property, it is the almost universal practice to provide living quarters for track foremen and for track laborers. The road has given careful attention to the laying out of these facilities in order that they may not only be conveniently placed, but attractive in appearance. This is done by varying the design of the houses, but even more by keeping them well painted, insuring that the roofs are free from leaks, etc. Beyond this, the employees are urged to co-operate in providing walks, planting shrubs and trees and otherwise improving their surroundings.

To further stimulate interest, this road includes in its annual track inspection, the inspection of all quarters, inside and out. Each company house is visited by the committee, a fact which stimulates a surprising degree of pride among the families of the employees, whether in specially built houses or in box car assemblies. Not only are the homes at their best at the time of the inspection, but a word of commendation here and there has been found to stimulate uniform maintenance throughout the year.

By these means, the road has found it possible to arouse the ambition of the employee and of his wife to such an extent that their homes are frequently the most attractive in their communities. Furthermore, these employees, by reason of the work that they have put into their homes, develop a feeling of proprietary interest which lessens their desire to move and makes of them more permanent and dependable employees. By arousing the interest of its men in the homes, this road has converted its company houses from a liability into an asset of marked value.



Substructure Work on the Suisun Bay Bridge of the Southern Pacific

Other articles in this series on the Operation and Maintenance of Track Motor Cars will appear in succeeding issues as follows:

Group A—Design and Construction

4—The construction of the car.

Group B—Operation

5—Lubrication of motor cars.
6—Motor car ignition.
7—The efficient operation of motor cars.
8—The safe operation of motor cars.

Group C—Maintenance

9—Field maintenance.
10—Shop maintenance.
11—Organization for maintenance.
12—Cost of operation and economy of motor cars.

The Motor Car

The two-cycle and four-cycle cooling, carburetion and

By C. R. KNOWLES‡

THE POWER produced by any internal combustion engine is derived from the expansion of gases ignited within one or more cylinders and acting against a movable piston which is forced out and away from the head end of the cylinder. The power is utilized by converting the motion of the piston into a rotary motion by means of a connecting rod and a crank-shaft. In order to maintain an even rotation and a uniform output of power, a flywheel is required on the crank-shaft, although where the axle of the car acts as a crank-shaft the wheels of the car function in place of the flywheel.

Practically all internal combustion engines designed for use on motor cars burn gasoline. The gasoline is admitted to the cylinder after passing through a carburetor or mixing valve where it is mixed with air in the proper proportions to form an explosive gas. The ignition of the gas in the cylinder is effected by means of an electric spark produced from a battery or magneto.

The engines are of two general types, four-cycle and two-cycle, both of which operate on the same basic principles common to all internal combustion engines. They may be further classified according to the method of cooling and the number of cylinders used.

All internal combustion engines operate in four steps: (1) Drawing in a charge of combustible gases; (2) compressing the charge; (3) burning the charge, which generates the power impulses; (4) exhausting the burned and expanded gases.

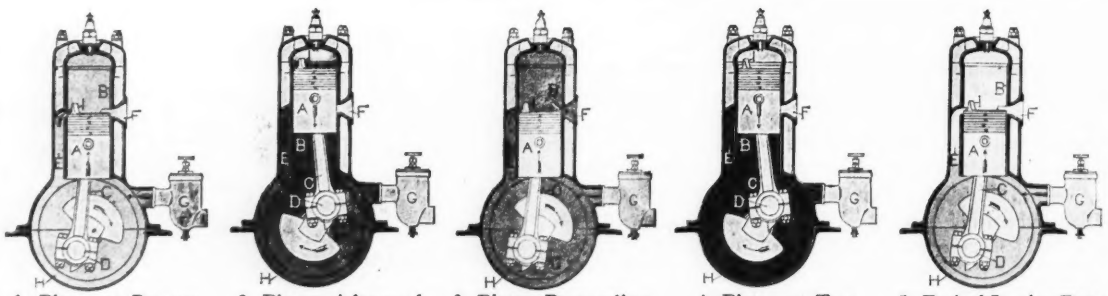
In the four-cycle engine, all steps in the cycle of operation are carried out above the piston, a power impulse occurring at every second revolution of the crank-shaft, or complete stroke of the piston and the regulation of the incoming and outgoing gases being controlled through the medium of valves. With the two-cycle engine, two of these steps are performed at each complete stroke of the piston, thus giving a power impulse on every revolution. No valves are required with the two-cycle engine as the control is performed by the piston itself, the gases passing above and below the piston and being admitted to the cylinder through ports or by-pass openings in the side walls.

Two-Cycle Engines

Two-cycle engines are of two general types, which are distinguished by their arrangement for the handling of the incoming charge of gas; they are commonly known as two-port and three-port engines. To all practical purposes the third port in the three-port type is for the purpose of controlling the incoming charge of gas and eliminating check valves between the carburetor and the crank case. In both classes of two-cycle engines, the crank case bears an important relation to the efficient and satisfactory operation of the engine since the incoming charge of gas is invariably taken in through the crank case

* The third of a series of 12 or more articles on the Care and Operation of Motor Cars, the first of which appeared in the January issue, page 5, and the second in the February issue, page 54.

‡ Mr. Knowles is in charge of the operation and maintenance of motor cars and other gasoline-operated work equipment on the Illinois Central System.

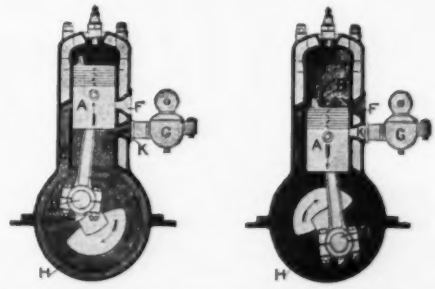


1. Piston at Bottom, Ports Open
2. Piston Advanced, Fuel Drawn In
3. Piston Descending, Fuel Compressed
4. Piston at Top, Charge Ignited
5. End of Stroke, Ports Open, Gas Renewed

Operation of the Two-Cycle, Two-Port Internal Combustion Engine

Power Plant

engines explained; lubrication ignition described in detail†*



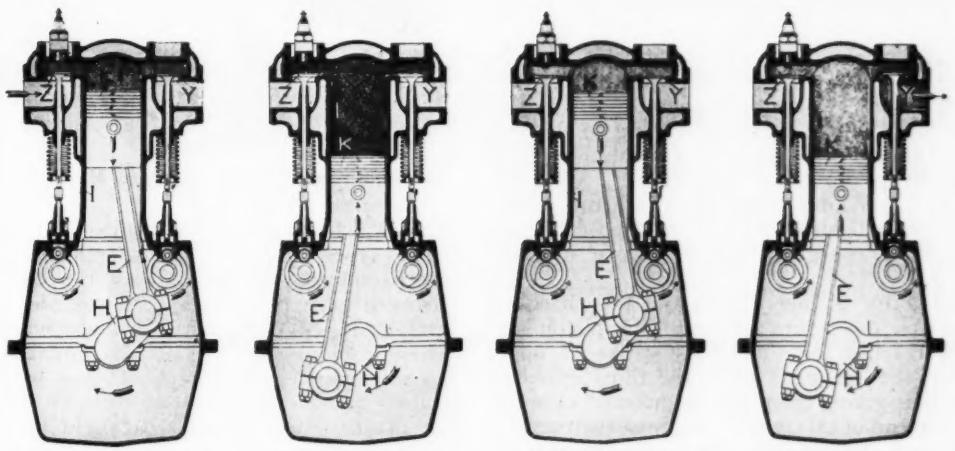
1. Piston Advancing, Fuel Entering From Third Port, K
2. Piston at Bottom, Compressed Charge Entering Cylinder

Operation of the Two-Cycle, Three-Port Internal Combustion Engine

before it is passed into the cylinder proper. This is better understood by describing an entire cycle of operation of a two-port and then of a three-port engine.

With the piston at the bottom of its stroke, a partial vacuum is created in the crank case as the piston moves towards the cylinder head, thus drawing in a charge of gas from the carburetor, the amount of which depends, of course, upon the throttle opening. Reaching the top of its stroke, the piston then descends, compressing the charge of gas in the crank case, which is prevented from escaping by the check valve already mentioned. The pressure so created is ordinarily low, generally varying from two to eight pounds per square inch. As the piston reaches the bottom of the stroke two ports located diametrically opposite in the cylinder are uncovered. These are known as the intake and exhaust ports. The mixture in the crank case, being under pressure, immediately rushes through the by-pass connecting the crank case with the inlet port, where, in passing into the cylinder, it strikes a baffle plate on the head of the piston, which diverts its flow toward the cylinder head. The piston then rises again, compressing the charge in the cylinder and at the same time drawing a new charge into the crank case. Again reaching the top of its stroke, the compressed mixture is fired and the piston is forced down on its working stroke, at the same time compressing the new crank case charge. As it opens the port on the lower limit of this power stroke and on all succeeding ones, the burning gases, still under pressure and expanding, rush out through the exhaust port while the fresh charge rushes in simultaneously at the intake port.

The baffle plate already mentioned is placed close to the intake port to perform the very important function of hindering any exhaust gases from passing out that way. Its most efficient work, however, is the deflection of the incoming gases so that they pass up the side of the cylinder, filling the head, and, as the flow continues, filling the cylinder. Practically all burnt gases are driven out this way and completely replaced by the new charge. From this point the cycles continue as described, the engine making a power stroke on each revolution of the crank-shaft.

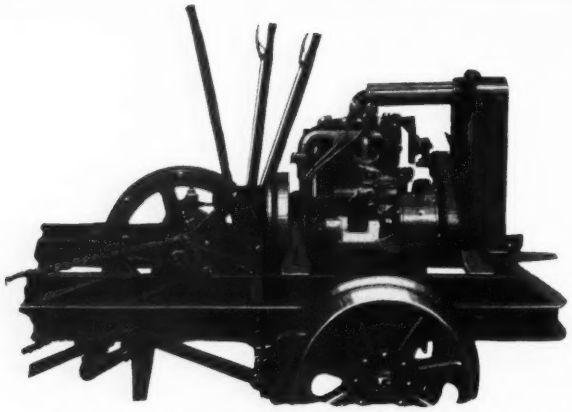


1. First Stroke, Valves Admitting Air
2. Second Stroke, Compression
3. Third Stroke, Explosion
4. Fourth Stroke, Exhaust

Operation of the Four-Cycle Internal Combustion Engine

The exhaust port is uncovered by the piston slightly before the intake port is opened so that the pressure from the exploded charge is released before the new charge is admitted. This difference in the time of opening the ports is termed the "lead" and must be correct in order that the engine may develop maximum power.

The three-port engine, as stated, differs only in its method of controlling the incoming charge. Similarly to the two-port engine, a partial vacuum is created in the crank case by the upward moving piston, but no gas is taken in until the piston reaches or nears the top of its stroke. At that point the lower edge of



A Kalamazoo Water-Cooled Friction and Chain Drive Motor Car Engine.

the piston uncovers a port connecting with the carburetor and the charge rushes in, completely filling the crank case as a result of the partial vacuum previously formed. As the piston descends, this port is closed and the gas compressed until, at the bottom of the stroke, the intake port in the cylinder proper is uncovered and the charge passes up through it. Outside of this variation in construction, the two types of engines operate in the same manner.

Four-Cycle Engines

The four-cycle engine is so named because only one step of the cycle of operation is performed during a stroke of the piston. For this reason and others it differs greatly from the two-cycle engine in that the control of the gases is accomplished through the medium of valves. There are generally but two of these, one to an intake manifold leading to the carburetor and the other to an exhaust manifold or pipe leading direct to the air or to a muffler. With the piston at its upper limit of travel and starting down, the inlet valve is opened and as the piston continues on its stroke a charge of gas is drawn into the cylinder.

The inlet valve is then closed and the charge is compressed by the return stroke of the piston. As the piston reaches the top of its stroke or upper dead-center, the charge is fired, the third stroke of the piston thus giving the power impulse. As the piston nears the end of this movement, the exhaust valve opens, allowing the still-expanding gases to rush out under their own pressure. This valve remains open during the return stroke, permitting the piston to force out any remaining gases and thus thoroughly scavenging the cylinders. On reaching the upper dead-center, the cycle is repeated as described, the power impulse occurring on every second revolution.

Two-Cycle Versus Four-Cycle Engines

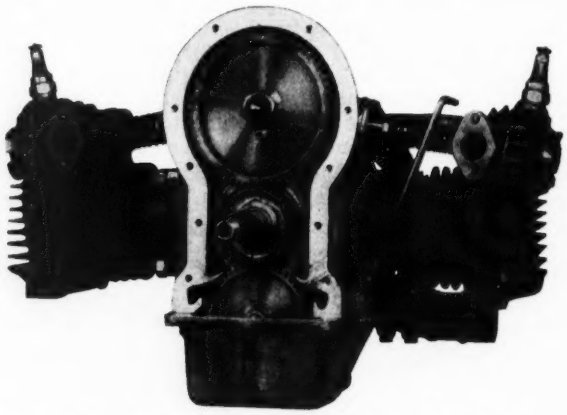
The four-cycle engine is generally conceded to be more economical than the two-cycle in the consumption of fuel on account of the more thorough scavenging of the burned gases, thus avoiding a mixture of the burned and fresh gases, although correct timing, the better design of the piston and cylinder head and properly proportioned inlet and exhaust parts of two-cycle engines have done much to overcome this objection.

The two-cycle engine is simpler in design than the four-cycle engine, there being only about one-half the number of parts employed in its construction as in the four-cycle engine. A two-cycle engine is reversible and runs equally well in either direction, while a special reversing cam is necessary with a reversible four-cycle engine.

Design of Engines

Many different types of engines have been applied to motor cars. Those most commonly used are one and two-cylinder engines of both two and four-cycle types, air or water-cooled and bolted direct to the frame of the car. Where a belt drive is used, the proper tension of the belt is maintained by means of an idler pulley or by moving the engine on a sliding base bolted to the frame or platform of the car, the engine being held in place either by bolts passing through slotted holes in its base or by clamp guides.

Two-cylinder engines, such as are used on motor cars, are principally of the opposed cylinder type with the crank case between the cylinders. Engines of this type are mounted with their cylinders at right angles to the track and the power is transmitted



A Buda Two-Cylinder Opposed Motor-Car Engine

through a friction disc and chain to the axle of car. Other types of two-cylinder engines are usually direct-connected to the axle of the car, either by means of gears or by using the axle of the car for a crank-shaft. All types of two-cylinder engines now in general use on motor cars are horizontal engines.

Three-cylinder engines have also been used on motor cars and many are still in use. They are of the direct-connected type with the axle forming the crank-shaft.

Four-cylinder, vertical automobile-type engines have come into use on motor cars in recent years. They are used principally for driving heavy duty cars, as they are too heavy and their cost is too great for general section or similar service. They are mounted in the same manner as on an automobile and the power is transmitted to the axle either through speed-reduction gears or by regular automobile transmission.

Methods of Lubrication

Two-cycle engines are lubricated by mixing the lubricating oil with the fuel, the internal parts of the engine thus being lubricated automatically. As the vaporized fuel passes through the crank case and cylinder, the lubricating oil, being less volatile than the gasoline, does not vaporize and burn as readily as the gasoline and is deposited on the walls of the cylinder and the moving parts within the crank case.

Two oiling systems are used on four-cycle

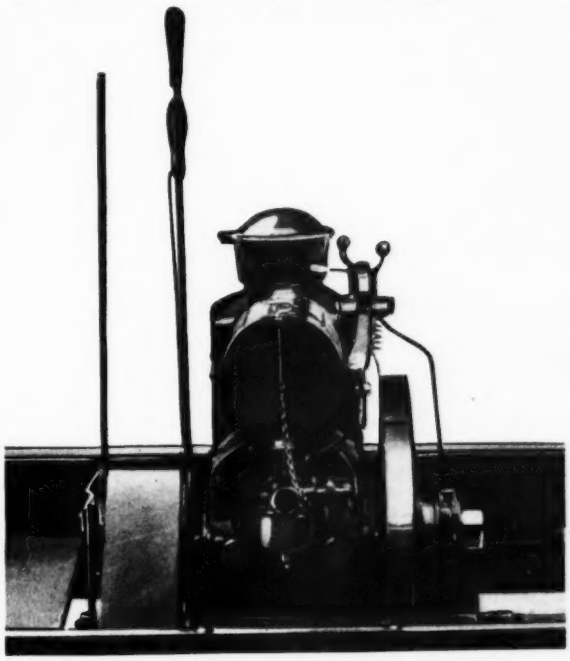
engines, the force feed system and the splash system. A force-feed oiling system consists essentially of an oil reservoir and an oil pump which forces the oil to the various parts to be lubricated. The required pressure is maintained by a small relief valve, the excess oil being returned to the reservoir. The force feed lubricator, used chiefly on larger stationary engines, operates in a manner similar to the force feed system, except that the oil is pumped in the required amount (measured in drops per minute) to tubes which carry it by gravity to the various parts of the engine.

With the splash system of lubrication, the oil is placed in the crank case and a projection from the connecting rod picks up a small amount at each revolution, which it throws on the various moving parts within the cylinder and crank case.

Cooling Systems

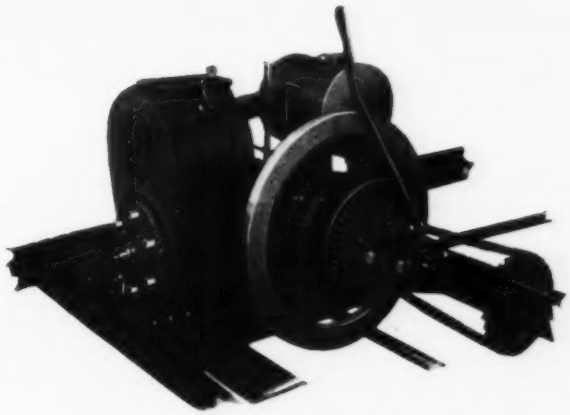
A cooling system of some kind is necessary with every internal combustion engine, as the successive explosions of the gases in the cylinder generate such intense heat that the cylinder would otherwise soon become overheated, resulting in the sticking of the piston and ultimately in the destruction of the cylinder. Both air and water are utilized as cooling mediums on motor car engines.

Air-cooled engines are provided with fins cast on the cylinder and other parts of the engine subjected to the heat of the burning gases, the purpose of which



A Casey-Jones Water-Cooled Belt-Driven Motor Car Engine.

is to increase the surface exposed to the air and thereby enlarge the radiating effect. The engine is mounted on the car in such a manner that a free circulation of air is maintained around the cylinder. In some cases, fans are provided to assist in promoting a circulation of air about the cylinder. These fans are sometimes driven by a belt, but on the motor cars in common use the fan is formed by the spokes of the flywheel, these spokes being flat and set at an angle similar to that of the vanes of a fan so that, as they revolve, they create a circulation of air about the cylinder.



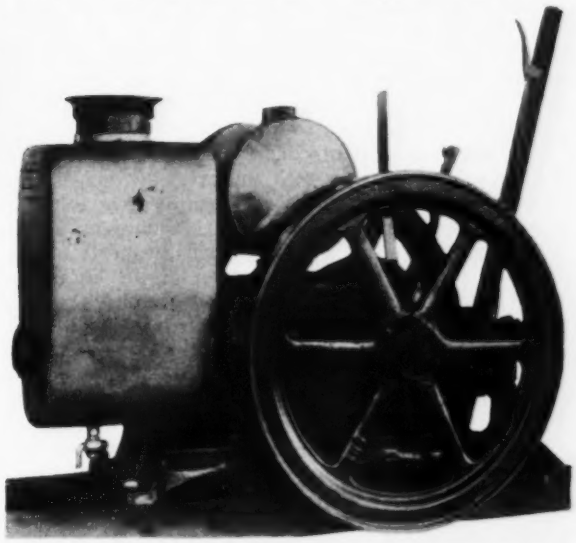
A Sheffield Water-Cooled Clutch and Chain Drive Motor Car Engine.

Water-cooled engines are cooled by means of the circulation of water through a water jacket surrounding the cylinder. In the types of engines commonly used for maintenance of way service, the water is carried in a cast iron or aluminum vessel, commonly referred to as a hopper, which completely encloses the cylinder, forming a water jacket, as well as a container for the required amount of water. A cooling system of this type is entirely automatic, and no attention is necessary other than to keep the hopper filled with the required amount of water and to take the necessary precautions against the freezing of the water during cold weather.

The larger cars, such as heavy inspection cars designed for long continuous runs, are usually provided with a radiator and pump for circulating the cooling water, the cooling system being similar to that on an automobile. The water is circulated through the water jacket of the cylinder to the radiator, where it is cooled and returned to the pump.

The water-cooled engine is adapted especially to long runs or to operation at low speeds, as when pulling heavy loads or when the engine may be operated to drive tools and the car is not in motion.

A water cooling system adds considerably to the weight of the engine as the type usually employed on motor car engines consists of a hopper which, when

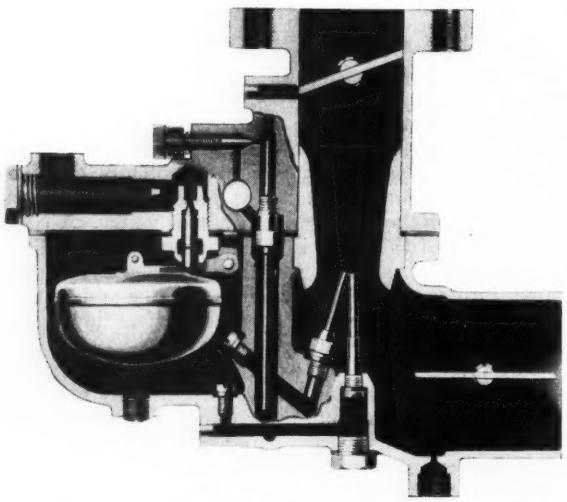


A Fairmont Water-Cooled Belt-Driven Motor Car Engine.

filled with water, weighs practically as much as the engine itself. The advantages are generally considered sufficient to offset this objection, however, and most of the motor car manufacturers are building cars equipped with water-cooled engines.

Carburetion

The questions of proper carburetion and ignition are solved in the same general manner for all types of engines, although differences are commonly found in the carburetors of some types of two-cycle and four-cycle engines. Carburetion consists essentially of creating a mixture of gasoline or kerosene vapor and air in such proportions that the vapor will burn completely while confined under pressure. The result is obtained generally by allowing a current of air created by the suction of the motor, to pass over or around a nozzle or a series of small openings con-



Sectional View of a Typical Carburetor for Motor Car Engines.

nected with the gasoline supply, the effect of which is to carry away a certain proportion of the fuel, which is vaporized as it is taken up and carried out through the carburetor and manifolds. The proper size of nozzles or jets, the height to which the gas should stand in them, and the volume of the air passing through in proportion to the degree of suction have all been determined by tests, painstaking study and numerous designs. Ordinarily these factors require little attention from the operator of a motor car except under widely varying weather conditions. Obviously a current of cold air will not vaporize as much gasoline as a current of warm air, so that in cold weather the amount of gasoline available for vaporization must be increased or the amount of air decreased to maintain the correct proportion. In order to control the power output of the engine, a valve is usually built into the carburetor by which the amount of combustible mixture can be regulated. On most motor cars, this is connected to a small handle, mounted either on the side of the engine proper or on the deck of the car and known as the hand throttle.

Ignition

Ignition, or the firing of the explosive charge in the cylinder, is accomplished chiefly by a jump spark, a high voltage current generated through the medium of a battery and spark coil or magneto, the spark being transmitted to the cylinder by the spark plug. Control of the spark in relation to the piston movement is accomplished through the medium of some such device as a timer, which, fundamentally, is merely a system of contacts connected to the electrical system and to the mechanism of the engine itself. With the device set in the full retard position, the relation of its parts to the crank-shaft of the engine is such that contact will be made only when the piston reaches the upper dead-center of the firing stroke. Two general systems are used, one where the battery current is controlled by a timer, with separate coils and wires leading to the spark plugs where there is more than one cylinder, and the other where the secondary current as well as the battery or primary current is controlled by a special type of timer known as a breaker-box and distributor. Full retard of the spark, as it is commonly called, is the ignition of the charge, either exactly at the top dead-center or very slightly after it. With the engine running, the spark is advanced; that is, its point of ignition or firing is changed so that the spark occurs a point ahead of dead center or before the piston reaches the top of the stroke. The amount of this advance varies with the speed of the engine and is fixed to secure the most efficient burning of the charge for the following reason: Since the action of a compressed mixture is not an explosion in the true sense of the word, but rather a burning action obeying all of the vagaries and laws of burning substances, the ignition of a full charge is not instantaneous for it requires some time for the flame to spread from the point of the spark to the other points of the charge. Thus in order to have all of the charge ignited and starting to burn at the beginning of the power stroke, it is necessary to ignite it slightly in advance. The amount of the advance, as stated, depends upon the rate at which the engine is turning over and is one of the reasons why the proper manipulation of the spark is important in the performance of any gasoline engine.

More Prize Awards

FOLLOWING are summaries of the results of the annual track inspections on the Delaware & Hudson, the Chesapeake & Ohio, the Baltimore & Ohio, the Erie, and the Southern Pacific Lines in Louisiana and Texas, with brief statements of the bases upon which the prizes were awarded.

Thorough Inspection on C. & O.

In the annual inspection on the Chesapeake & Ohio, the system trackage was divided into four groups, according to the character of the track and the traffic handled over it. In each of these groups a first prize of $50 and a second prize of $25 were awarded to the supervisors whose subdivisions received the highest ratings. Additional prizes of $25 and $15, respectively, were awarded to the foremen on the first and second best maintained sections on each supervisor's subdivision. A special prize of $50 was also made to the subdivision on the system which had shown the greatest improvement during the year.

Following is a list of the winners of the group prizes:

Group 1—Double-track main line, freight and passenger traffic: First prize, J. L. Brightwell, supervisor on the Huntington subdivision; second prize, J. Henzman, supervisor on the Charleston subdivision.

Group 2—Single and double-track main line, prin-

cipally freight traffic: First prize, J. Broshears, supervisor on the Columbus subdivision; second prize, W. S. Spencer, supervisor on the Barboursville subdivision.

Group 3—Single-track main line, principally passenger traffic: First prize, R. H. Gibson, supervisor on the Mountain subdivision; second prize, C. A. Snodgrass, supervisor on the Wabash subdivision.

Group 4—Secondary branch lines: First prize, E. J. Rohr, supervisor on the Cheviot subdivision; second prize, W. L. Bennett, supervisor on the Loup Creek subdivision.

The system improvement prize for the year was awarded to E. G. Holesapple, supervisor on the Greenbrier subdivision.

$1,800 Awarded on the D. & H.

A total of $1,800 was awarded in 32 prizes on the Delaware & Hudson as a result of its annual track inspection made last fall. The following awards were made: First, second and third prizes of $50, $25 and $15, respectively, for the three best main-line sections on the system; first, second and third prizes of $100, $75 and $35, respectively, for the three best branch-line sections on the system; first, second and third prizes of $100, $60 and $35, respectively, for the three best maintained sections on each of the four main divisions of the road; first, second and third prizes of $100, $75 and $35, respectively, for the three best first-class and three best second-class yards on the system; and first and second prizes of $50 and $25, respectively, for the two sections on each of the four divisions, which showed the greatest improvement during the year.

The foremen winning the first prizes in these various classifications are included in the following: For the best main line section on the system, Frank Mazzarella, at Sidney, N. Y.; for the best branch line section on the system, V. Santarcangelo, at Ballston Lake, N. Y.; for the best section on the Champlain division, Gastona Ciccone, at Plattsburg, N. Y.; for the best section on the Saratoga division, C. J. Woodbury, at Smiths Basin, N. Y.; for the best section on the Susquehanna division, Frank Mazzarella, who also won the system first prize; and for the best section on the Pennsylvania division, Stifo Napoli, at Dickson, Pa. The first prizes for the best first and second class yards on the system were won by Patrick Whalen, at Binghamton, N. Y., and Benny Lorado, at Plattsburgh, N. Y., respectively. The first prizes on the divisions for the greatest improvement in sections, were awarded to Mike Altieri, at Montcalm Landing, N. Y., on the Champlain division; Joseph Izzo, at Mechanicville, N. Y., on the Saratoga division; John L. Monahan, at Oneonta, N. Y., on the Susquehanna division; and George Freeman, at Moosic, Pa., on the Pennsylvania division.

B. & O. Makes 71 Prize Awards

Seventy-one cash prize awards, totaling $3,940, were made to foremen and supervisors on the Baltimore & Ohio as a result of the annual track inspection for 1929. Eighteen supervisors were awarded prizes of $100 for having maintained the best districts on the various divisions; 19 foremen were awarded prizes of $50 for having maintained the best main-line sections on the different divisions; 19 foremen were awarded prizes of $35 for having sections which showed the greatest improvement during the year, and 15 additional foremen were awarded prizes of $35 for having maintained the best branch-line sections.

Following is a list of the 18 supervisors who were awarded prizes for the best subdivisions during 1929: E. C. Parks, Laurel, Md.; C. W. Selby, Point of Rocks, Md.; W. R. House, Cumberland, Md.; M. W. Faffey, Piedmont, W. Va.; L. T. Wilfong, Clarksburg, W. Va.; A. L. Lowe, Huntington, W. Va.; J. E. Conley, Gassaway, W. Va.; B. F. Hanna, Rockwood, Va.; J. W. Kimmins, West Newton, Pa.; J. W. Riggans, New Castle, Pa.; J. I. Malone, Cleveland, Ohio; W. Carpenter, Garrett, Ind.; D. R. Bowman, Barnesville, Ohio; J. E. Weaver, Washington, Ohio; T. Rowland, Seymour, Ind.; J. F. Thome, Washington, Ind.; E. Ledger, Dayton, Ohio, and W. M. Wells, Indianapolis, Ind.

Prizes Awarded to 97 on the Erie

Ninety-seven cash prizes, totaling $9,850, were awarded to supervisors and foremen on the Erie for having maintained the best subdivisions and sections during 1929. First and second prizes of $200 and $100, respectively, were awarded to the supervisors on each of the three main districts of the road whose subdivisions had the highest and next to the highest ratings. Thirteen Banner prizes of $150 each were made to the foremen whose sections received the highest ratings on each division, and in addition, 44 first prizes of $100 and 32 second prizes of $75 were given to the foremen who received the first and second highest ratings on individual subdivisions. The supervisors who were awarded first and second prizes on the Erie are as follows:

Division	Amount
New York District, Main Line	
New York—C. L. Connor, Paterson, N. J.	$200
New York—W. H. Wahl, Campbell Hall, N. Y.	100
New York District, Branch Lines	
N.Y.S. & W.—G. J. Daly, Riverside, Paterson, N. J.	100
Eastern District, Main Line	
Susquehanna—P. J. Keenan, Cuba, N. Y.	200
Alleghany—J. E. Whalen, Elmira, N. Y.	100
Eastern District, Branch Lines	
Tioga—W. L. Kelly, East Buffalo, N. Y.	100
Western District, Main Line	
Marion—A. J. Bernard, Jamestown, N. Y.	200
Kent—J. Lyman, Cleveland, Ohio	100

Southern Pacific Lines Award $6,675

A total of $6,675 was paid out in prize money to the section foremen whose sections received ranking scores in the annual track inspection held on the Southern Pacific Lines in Texas and Louisiana, during December, 1929, and January, 1930. Awards of first, second and third prizes of $100, $75 and $50, respectively, were made in 30 roadmasters' districts.

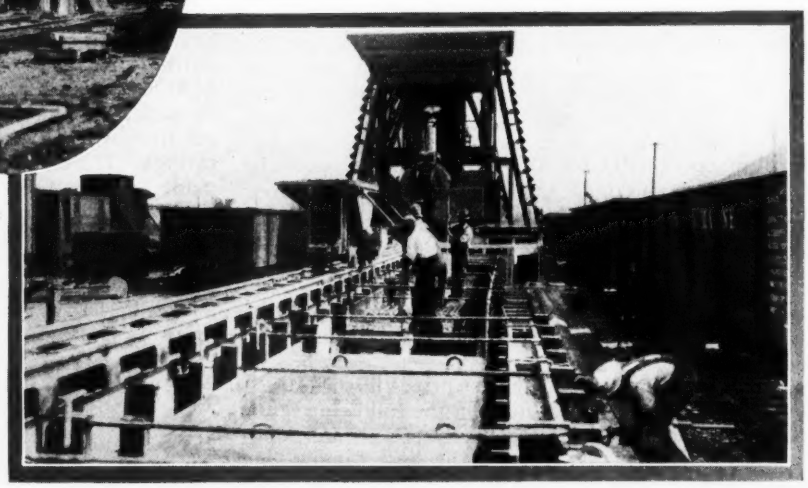
The El Paso division received the highest division rating for the tenth consecutive time. However, the territory of A. W. Wehner, roadmaster of the Echo district of the Lafayette division, received the highest rating of any roadmaster's district, the score being 96.3. The section in charge of Foreman Dave Bergeron, namely Section No. 8 of the Morgan City district, Lafayette division, received a score of 97.2 which was the highest rating received by any section on the entire system.

Large Lettuce Movement.—The Southern Pacific has moved 250 carloads of lettuce daily from the Imperial Valley this season. On March 1, the total shipments aggregated 9,528 carloads, an increase of 1,039 cars over the corresponding period last year. Eighty-six per cent of this crop goes to the eastern market.

Introducing Mass

in Building

Boston & Maine plant at Concord, N. H., cost and in improving the



FOLLOWING the decision to substitute permanent structures for timber wherever possible, the Boston & Maine established a reinforced concrete slab plant at Concord, N. H., in 1927, at which during the last two years, it has constructed about 450 slabs for the smaller openings under the railroad at a considerable saving over what it would have cost to have constructed these slabs at the various points of installation. In addition, the plant is now manufacturing reinforced concrete rail rests for use over the system, and may ultimately manufacture many other classes of concrete units, such as fence posts, station platform curbing, trestle bents, overhead bridge stringers, roadway sign posts, etc.

Many Advantages in Central Plant

In addition to the need for more than 1,500 track slabs of 20-ft. span or less in the general improvement and track strengthening program, there were many important considerations which led to the decision to build these slabs at a central point. In the first place, it was known that, under the more favorable conditions that would exist at a permanent plant, and with the closer supervision, a much higher class of concrete units could be produced, both as to appearance and durability, than could be constructed in the field. With so large a volume of work, it was also known that the cost of construction could be considerably reduced.

These advantages have been fully demonstrated at the Concord plant. At this point, which is about central on the system and the headquarters of the Southern division, all of the concrete work is carried out under the direct supervision of the division engineering officers, and of a plant general foreman who is a specialist in concrete work; a good quality of water, sand and gravel is assured; the most up-to-date equipment is employed; the labor force is permanent and is skilled in the work to be done; and the forms for the concrete units can be used over and over again. At the same time, the cost of setting up a temporary concrete plant at each bridge site is eliminated; the cost of transporting concrete aggregates to numerous places on the road and of handling them, usually without the aid of labor saving equipment, is done away with; and practically all traffic interruptions are avoided in placing the slabs. Among the special advantages resulting from the locating of the slab plant at Concord are the fact that Concord has unusually frequent train service and is in direct connection with all parts of the road, and the further fact that the New Hampshire State Laboratory is located at this point and is equipped for making tests of all concrete mixed at the plant.

Description of the Concord Plant

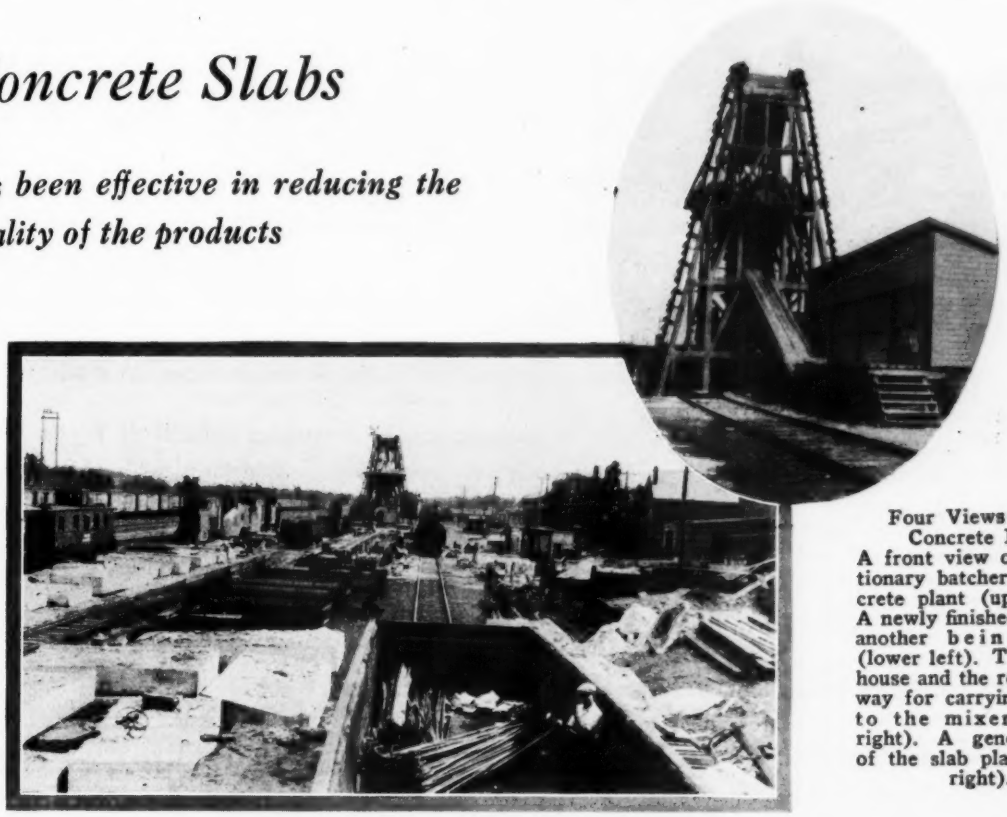
The slab plant is located just east of the passenger station at Concord, near the division bridge and building carpenter shop, and occupies space along the west side of a small yard at this point. During the present year, the original layout provided during 1927 and the early part of 1928 was completely altered and enlarged to meet the increased demand and, in the final arrangement, all of the most up-to-date features have been incorporated to make it possible to manufacture the slabs in the most efficient and economical manner.

The present layout includes essentially a stationary concrete mixing plant, with all of the equipment necessary for the economical handling of cement and concrete aggregates and for accurately controlling the mixes used; a 1,500-bag cement storage house with an unloading platform; two long pouring platforms, sufficient in size to hold 14 of the largest slabs cast at the plant; a raised timber platform for assembling the slab rein-

Production Methods

Concrete Slabs

has been effective in reducing the quality of the products



Four Views of the Concrete Plant
A front view of the stationary batcher and concrete plant (upper left). A newly finished slab and another being poured (lower left). The cement house and the roller skidway for carrying cement to the mixer (upper right). A general view of the slab plant (lower right).

forcing; a relatively small concrete platform for the pouring of rail rests; and sufficient curing grounds for holding all of the slabs and rail rests manufactured, until they are moved away for installation. The entire plant, with the exception of a portion of the curing grounds and the rail rest pouring platform, is located between and is served by two stub end tracks, spaced 40 ft. 9 in. center to center, which are used for the delivery of sand and gravel and for handling the finished slabs to the curing grounds. In addition to these two main tracks, a third stub track serves the cement storage house.

Various Size Slabs Cast On Same Platforms

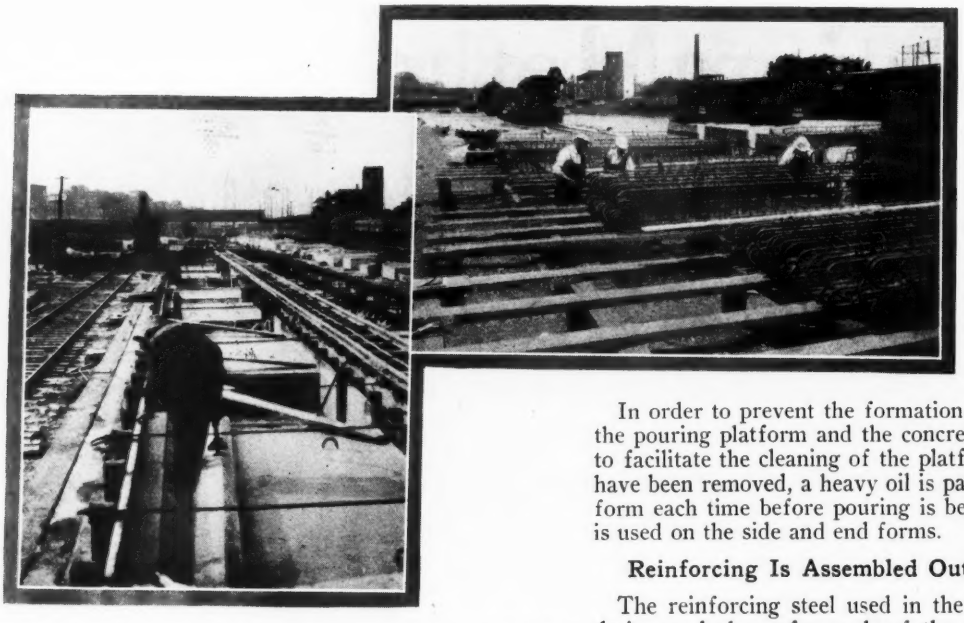
The two slab-pouring platforms, which are of concrete, are, in reality, one large platform, 161 ft. long by 25 ft. wide, divided longitudinally through the center by a concrete wall, 15 in. wide and 3 ft. 3 in. high. The lower part of the platform, which is called the working area, is at an elevation three inches above the top of the track rails on each side, while the wall dividing the platform longitudinally is called the tramway wall and supports an industrial track of two-foot gage, over which moves a concrete car in delivering concrete from the mixer to the forms.

The slabs being built at the plant are designed to accommodate clear spans between abutments of from 4 ft. to 20 ft., and with overall lengths of from 6 ft. to 23 ft. The slabs are of two distinct types, known as "X" and "Y" slabs. The X slabs are 8 ft. wide and are provided with a parapet along one side to hold the ballast, while the Y slabs, which are used only in conjunction with X slabs in double-track structures, are 6 ft. 6 in. wide, without parapets. For single track, two X slabs are required, and for double track, two X slabs with two Y slabs between them give the desired width.

The depth or thickness of the slabs varies with their length; slabs of from 4-ft. to 7-ft. span being 1 ft. 2 in. deep, slabs of from 8-ft. to 11-ft. span being 1 ft. 6 in. deep, slabs of from 12-ft. to 16-ft. span being 1 ft. 11 in. deep, and slabs of from 17-ft. to 20-ft. span being 2 ft. 6 in. deep. The parapets on the X slabs are provided to retain the track ballast, and are increased in height, as may be necessary, to hold the ballast where there is superelevation in the track over the bridge. All of the slabs are provided with four lifting hooks extending above the top surface; they are waterproofed on the top face by a coating of Headley emulsified asphalt; and the top surface is pitched one inch longitudinally either one way, or both ways from the center to provide drainage.

Special Forms Are Used

The forms for making the slabs are constructed of 2-in. hard pine, with 4-in. by 6-in. backing posts, and are covered with 22-gage galvanized iron. This iron is added to protect the timber in the forms and to provide a smooth surface on the finished concrete, but in some cases it has created a wave-like appearance on the concrete. With the idea of eliminating this, and to secure a perfectly smooth face on the outside of the X slabs, which are exposed to view in the finished structure, an experiment is now being made with a ¼-in. iron plate on the inside of the outside X-slab forms.



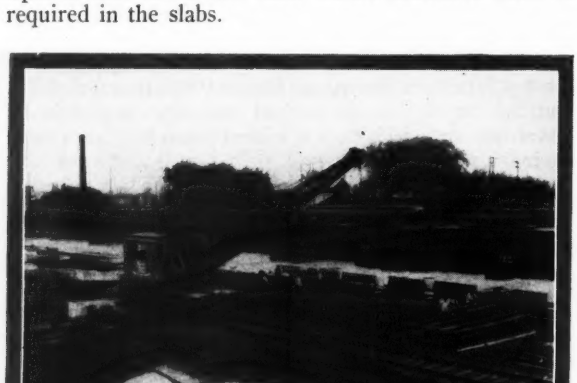
Tying up the slab reinforcing on the reinforcing assembly racks. Removing the parapet form from one of the X slabs (left).

The inside forms are of sufficient length and height for any of the slabs poured, and bear directly against the tramway wall through the center of the platform. Ordinarily, the end forms hold these forms upright until the concrete is poured, but special strap irons are provided which can be hooked over the top of the tramway wall for this purpose.

Outside and Inside Forms Similar

The outside forms for the slabs are similar to the inside forms, and the same outside forms are used for both X and Y slabs of any depth. When X slabs are being poured, however, special form strips are used in conjunction with the outside forms to shape properly the depth of parapets desired. The outside forms are braced at the bottom against 4-in. by 8-in. waling strips anchored to the concrete platform, and are held truly vertical by means of ¾-in. steel tie rods which extend from the backing posts of the inside forms to the backing posts of the outside forms.

The end forms for the slabs are variable in height, and are interchangeable in that end parapet forms can be attached to either end. These forms are braced at both top and bottom against waling strips anchored to the concrete platform between each of the form areas. Special end forms are used where excessive skew is required in the slabs.

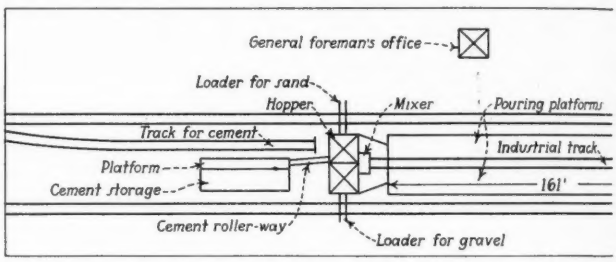


Assembling Reinforcing for the Slabs

In order to prevent the formation of a bond between the pouring platform and the concrete of the slabs, and to facilitate the cleaning of the platform after the slabs have been removed, a heavy oil is painted over the platform each time before pouring is begun. A similar oil is used on the side and end forms.

Reinforcing Is Assembled Outside of Forms

The reinforcing steel used in the slabs is of special design and shape for each of the types and sizes of slabs made. All of the reinforcing, which consists of rods, bars and stirrups, suitably bent, is assembled on special racks at the north end of the pouring platform,



The Mixer Plant and Part of the Pouring Platform

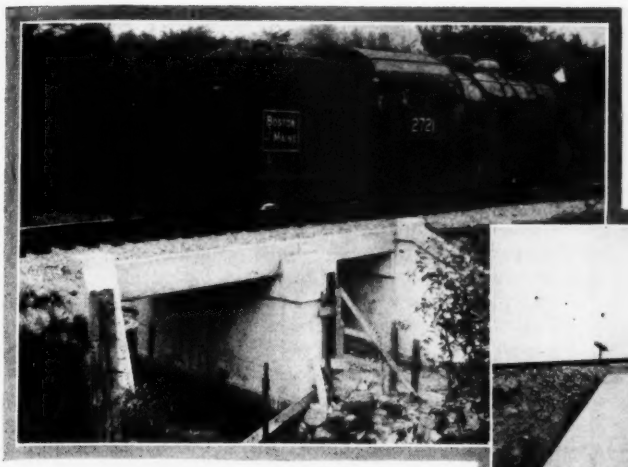
and is tied together into cage-like form with No. 16-gage wire. When completely assembled, the reinforcement for any of the slabs can be picked up as a unit by the 15-ton self-propelled gasoline crane employed in various operations at the plant and out on the division, and placed into the proper form.

The assembled reinforcing for the various size slabs varies in weight from about 535 lb. for a 4-ft. span X slab, to about 5,740 lb. for a 20-ft. span X slab, and the number of reinforcing ties used in the various reinforcement assemblies varies from about 288 to well over 1,700. All of the work of assembling the reinforcement is done by laborers who have become proficient in this work.

Modern Mixing Plant Is Provided

The mixing plant for preparing the concrete used in the bridge slabs is located directly in line with the pouring platform at its south end, and is modern in every respect. It consists essentially of a 72-ton self-cleaning Blaw-Knox batcher served by two chain bucket conveyors, one for sand and the other for gravel; a six-bag or one-yard Ransome concrete mixer; and a roller-way over which cement is elevated to the mixer.

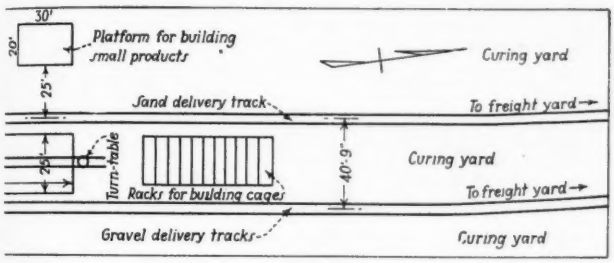
The batcher, which is elevated on a steel tower, has a two-part steel aggregate hopper, from which predetermined amounts of sand and gravel are released at a time into batch boxes directly beneath. Subsequently, the contents of the batch boxes, together with six bags



A combination waterway and cattle pass in double-track territory employing two spans of different lengths (left). One of the first of the bridge slabs installed on the Southern division (below).

of cement, are discharged over the skip of the concrete mixer into the revolving mixer drum which has previously been supplied with a predetermined quantity of water from a calibrated water drum mounted over the mixer.

One of the bucket conveyors operates on each side of the hopper, and they extend from below the plant service tracks to a height of about 43 ft. above the tracks,



The Curing Yards and Other Plant Facilities

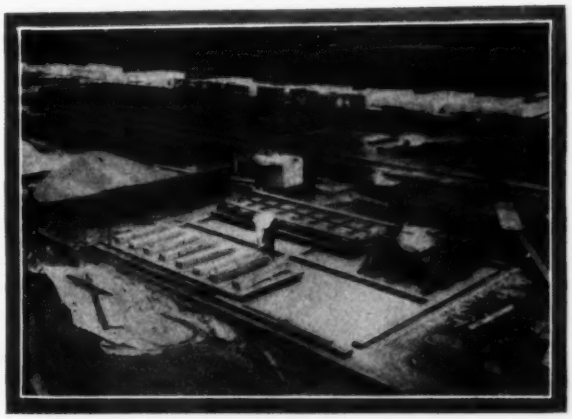
where they empty into separate chutes leading to the two parts of the aggregate storage bin. At present, both sand and gravel are delivered to the plant in flat-bottom, gondola-type coal cars, with drop bottom doors, and as each of these doors is spotted in line with one of the conveyors and opened, the sand or gravel drops to the track level and over a short chute which feeds the buckets of the conveyor. As this method necessitates much shoveling of the aggregates from cars, and has not been entirely satisfactory in loading the buckets uniformly without manual assistance, the B. & M. is now installing a track hopper under each of the service tracks, together with a Climax vibrating feeder, which it plans to use in connection with the delivery of aggregates hereafter in hopper-bottom cars.

Cement is received at the plant in paper bags and, that which is not moved directly to the mixer, is stored in a frame building, about 40 ft. long by 10 ft. wide, located directly back of the mixing plant. The cement is elevated to the mixer in a six-bag car, equipped with a discharge gate with skids, which operates over a home-made roller skid-way about 55 ft. long and terminating at the top directly over a chute leading to the skip of the concrete mixer.

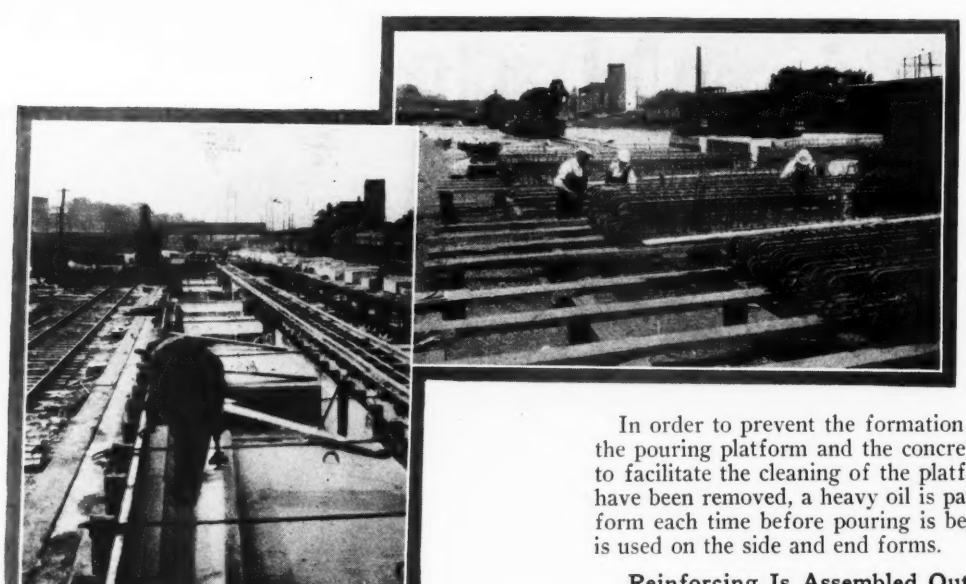
Concrete from the mixer is delivered to the slab forms on the pouring platform in a 32-cu. ft. side-dump concrete cart, which operates by means of drums and a cable over the narrow-gage track on the wall through the center of the pouring platform. As this car can be dumped to only one side, an improvised turntable, 10 ft. long, is provided at the end of the track away from the mixer, on which the car can be turned for dumping into forms on either side of the platform. All of the equipment at the plant, except the turntable, which is operated by hand, is electrically-operated by individual electric motors, suitably housed to protect them against dust about the plant.

Heavy Equipment Is Necessary

In casting the slabs, they are poured in order, beginning with the form most distant from the mixer, this to make it unnecessary for the car to pass slabs previously poured during the day, where it might cause danger or interference with the men putting the finishing touches on the slabs, or might drop fresh concrete on the top of the finished slabs. As the forms are filled, the cement is struck off and given a float surface on top. About 24 hr. after the completion of a slab it is wetted down for the first time in a regular program which keeps the slabs moist for 28 days. Water for wetting the slabs on the pouring platform is delivered along each side of the tram-car wall, near the top in a one-inch pipe, and each form area is provided with two outlets, equipped with special spraying heads.



View of the Rail-Rest Pouring Platform



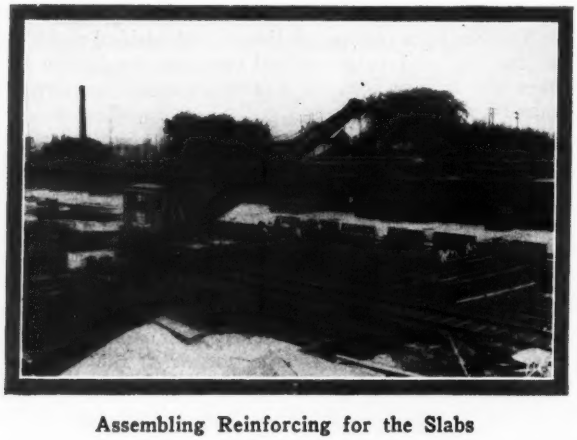
Tying up the slab reinforcing on the reinforcing assembly racks. Removing the parapet form from one of the X slabs (left).

The inside forms are of sufficient length and height for any of the slabs poured, and bear directly against the tramway wall through the center of the platform. Ordinarily, the end forms hold these forms upright until the concrete is poured, but special strap irons are provided which can be hooked over the top of the tramway wall for this purpose.

Outside and Inside Forms Similar

The outside forms for the slabs are similar to the inside forms, and the same outside forms are used for both X and Y slabs of any depth. When X slabs are being poured, however, special form strips are used in conjunction with the outside forms to shape properly the depth of parapets desired. The outside forms are braced at the bottom against 4-in. by 8-in. waling strips anchored to the concrete platform, and are held truly vertical by means of ¾-in. steel tie rods which extend from the backing posts of the inside forms to the backing posts of the outside forms.

The end forms for the slabs are variable in height, and are interchangeable in that end parapet forms can be attached to either end. These forms are braced at both top and bottom against waling strips anchored to the concrete platform between each of the form areas. Special end forms are used where excessive skew is required in the slabs.

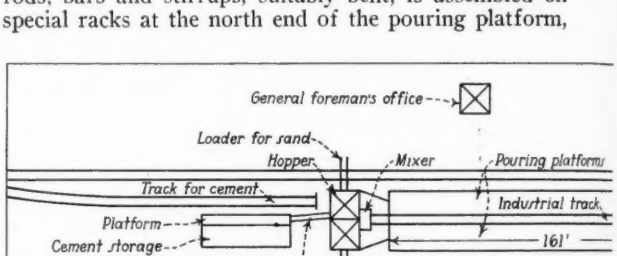


Assembling Reinforcing for the Slabs

In order to prevent the formation of a bond between the pouring platform and the concrete of the slabs, and to facilitate the cleaning of the platform after the slabs have been removed, a heavy oil is painted over the platform each time before pouring is begun. A similar oil is used on the side and end forms.

Reinforcing Is Assembled Outside of Forms

The reinforcing steel used in the slabs is of special design and shape for each of the types and sizes of slabs made. All of the reinforcing, which consists of rods, bars and stirrups, suitably bent, is assembled on special racks at the north end of the pouring platform,



The Mixer Plant and Part of the Pouring Platform

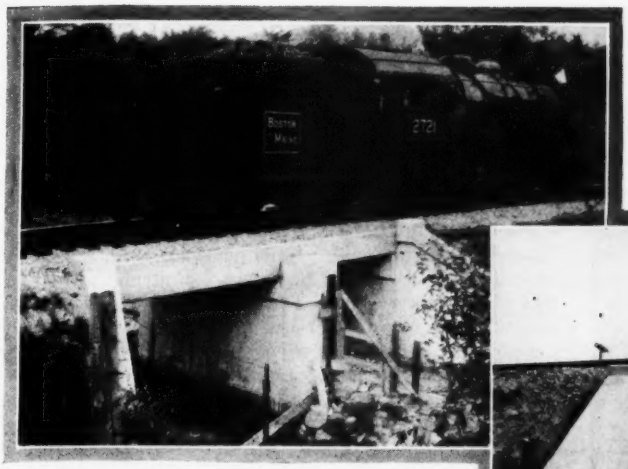
and is tied together into cage-like form with No. 16-gage wire. When completely assembled, the reinforcement for any of the slabs can be picked up as a unit by the 15-ton self-propelled gasoline crane employed in various operations at the plant and out on the division, and placed into the proper form.

The assembled reinforcing for the various size slabs varies in weight from about 535 lb. for a 4-ft. span X slab, to about 5,740 lb. for a 20-ft. span X slab, and the number of reinforcing ties used in the various reinforcement assemblies varies from about 288 to well over 1,700. All of the work of assembling the reinforcement is done by laborers who have become proficient in this work.

Modern Mixing Plant Is Provided

The mixing plant for preparing the concrete used in the bridge slabs is located directly in line with the pouring platform at its south end, and is modern in every respect. It consists essentially of a 72-ton self-cleaning Blaw-Knox batcher served by two chain bucket conveyors, one for sand and the other for gravel; a six-bag or one-yard Ransome concrete mixer; and a roller-way over which cement is elevated to the mixer.

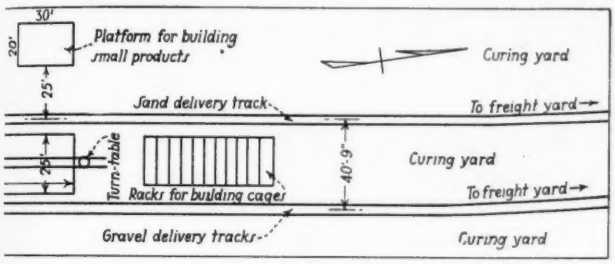
The batcher, which is elevated on a steel tower, has a two-part steel aggregate hopper, from which predetermined amounts of sand and gravel are released at a time into batch boxes directly beneath. Subsequently, the contents of the batch boxes, together with six bags



A combination waterway and cattle pass in double-track territory employing two spans of different lengths (left). One of the first of the bridge slabs installed on the Southern division (below).

of cement, are discharged over the skip of the concrete mixer into the revolving mixer drum which has previously been supplied with a predetermined quantity of water from a calibrated water drum mounted over the mixer.

One of the bucket conveyors operates on each side of the hopper, and they extend from below the plant service tracks to a height of about 43 ft. above the tracks,



The Curing Yards and Other Plant Facilities

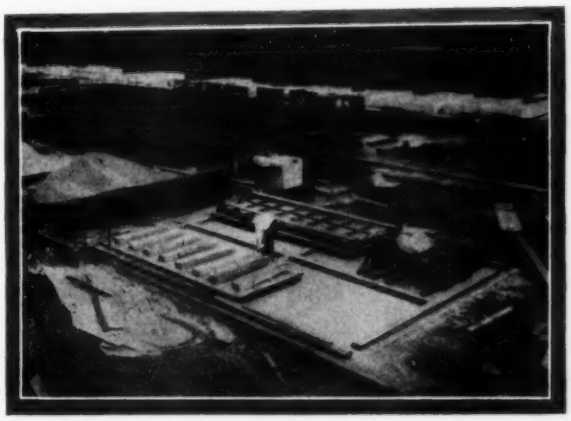
where they empty into separate chutes leading to the two parts of the aggregate storage bin. At present, both sand and gravel are delivered to the plant in flat-bottom, gondola-type coal cars, with drop bottom doors, and as each of these doors is spotted in line with one of the conveyors and opened, the sand or gravel drops to the track level and over a short chute which feeds the buckets of the conveyor. As this method necessitates much shoveling of the aggregates from cars, and has not been entirely satisfactory in loading the buckets uniformly without manual assistance, the B. & M. is now installing a track hopper under each of the service tracks, together with a Climax vibrating feeder, which it plans to use in connection with the delivery of aggregates hereafter in hopper-bottom cars.

Cement is received at the plant in paper bags and, that which is not moved directly to the mixer, is stored in a frame building, about 40 ft. long by 10 ft. wide, located directly back of the mixing plant. The cement is elevated to the mixer in a six-bag car, equipped with a discharge gate with skids, which operates over a home-made roller skid-way about 55 ft. long and terminating at the top directly over a chute leading to the skip of the concrete mixer.

Concrete from the mixer is delivered to the slab forms on the pouring platform in a 32-cu. ft. side-dump concrete cart, which operates by means of drums and a cable over the narrow-gage track on the wall through the center of the pouring platform. As this car can be dumped to only one side, an improvised turntable, 10 ft. long, is provided at the end of the track away from the mixer, on which the car can be turned for dumping into forms on either side of the platform. All of the equipment at the plant, except the turntable, which is operated by hand, is electrically-operated by individual electric motors, suitably housed to protect them against dust about the plant.

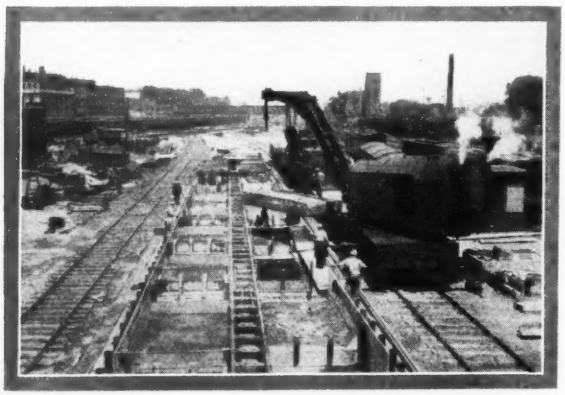
Heavy Equipment Is Necessary

In casting the slabs, they are poured in order, beginning with the form most distant from the mixer, this to make it unnecessary for the car to pass slabs previously poured during the day, where it might cause danger or interference with the men putting the finishing touches on the slabs, or might drop fresh concrete on the top of the finished slabs. As the forms are filled, the cement is struck off and given a float surface on top. About 24 hr. after the completion of a slab it is wetted down for the first time in a regular program which keeps the slabs moist for 28 days. Water for wetting the slabs on the pouring platform is delivered along each side of the tram-car wall, near the top in a one-inch pipe, and each form area is provided with two outlets, equipped with special spraying heads.



View of the Rail-Rest Pouring Platform

On the day following the pouring, a two-inch layer of sand is spread over the slabs to aid proper curing, the sand being deposited on the slabs by the gasoline crane, using a steel scale box. Four days after pouring,



Removing One of the Larger Slabs from the Pouring Platform With the 75-Ton Wrecking Crane

the slabs are removed to the curing grounds. All slabs up to 16-ft. span are handled by the 75-ton wrecking crane located at Concord. A 35-ton derrick, also located at Concord, assists this crane in handling the larger slabs because the latter does not have sufficient reach to handle them alone. The various slabs made at the plant vary in weight from about 3.6 tons to in excess of 38 tons each.

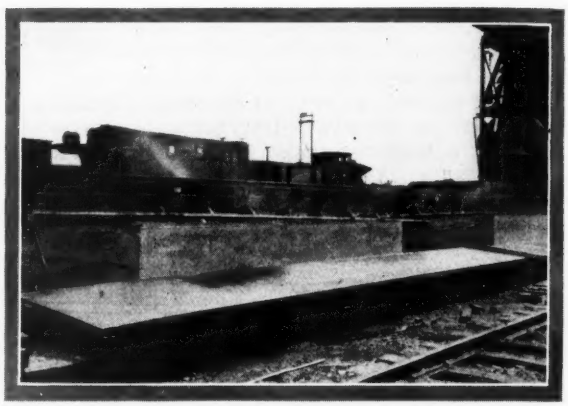
The slabs are moved to the site of installation on flat cars in regular trains or special work trains. Just before they leave the plant they are given a waterproof coating of emulsified asphalt on their top face. At the site of installation they are set in place either by the hoisting equipment employed at the plant, which may accompany the train, or by other suitable equipment provided by the division on which the installation is made.

Great Care Is Exercised in Making Slabs

In making the slabs the greatest care is exercised throughout to produce a high grade product. All of the concrete is proportioned in accordance with the water-cement ratio and is designed to have a strength of at least 2,000 lb. In accomplishing this, the water is carefully controlled; the sand and gravel are subjected periodically to analysis for weight, fineness modulus, bulking, free water, etc.; slump tests are made frequently; and in addition, two test cylinders are made from each day's pour and sent to the New Hampshire State Laboratory for test. Further, the strictest supervision is maintained to see that the concrete is thoroughly tamped, rodded and spaded in the forms, and as an additional precaution against air bubbles in the finished slabs, a specially adapted, electrically-operated vibrator is applied to the outside of the outside forms while the concrete is being placed.

How the Work Is Scheduled

All of the operations at the plant are carried out in accordance with a well defined program, with a force of 14 men and a general foreman. Pouring operations take place each week on Tuesday and Wednesday. On Thursday, Friday and Saturday the men clean about the pouring platform between the slabs, scrape off the tops of the forms, and assemble the reinforcing for the next week's pour. On Saturday also, all of the forms are knocked loose from the slabs and each slab is stenciled on one end with the division symbol and the number of the bridge in which it is to be used. Sunday the slabs are allowed to continue curing on the platform while the plant is idle, and on Monday they are removed



Wetting Down the New Slabs Still on the Pouring Platform

to the curing grounds, the platforms and forms are cleaned, and the forms are then set in place ready for pouring the next day.

All of this slab construction is under the general direction of H. F. Fifield, engineer maintenance of way, and R. Burroughs, division engineer. A. I. Gauthier, supervisor of bridges and buildings, has general supervision over the operations at the plant, while the actual work is in direct charge of R. M. Grower, general foreman of the plant.

Maintenance of Way Material Yard of the Santa Fe Stores Department at San Bernardino, Cal.

Curing Soft Spots in Track by New Method

Plan developed by St. Louis-San Francisco constitutes a radical departure from accepted practice

SOFT SPOTS in the roadbed have been known ever since the railways came into existence. In recent years, however, partly as a result of the remarkable increase in traffic which began with the opening of the present century, and partly owing to the greater weight of modern locomotives and the heavier loading of cars, soft spots develop frequently in places which previously have shown every evidence of stability for decades. In other places the soft roadbed has extended far beyond its original area, so that, where this trouble occurs, the conditions constantly become more acute, unless measures to cure the underlying cause are undertaken.

The St. Louis-San Francisco which, in common with almost every other railway in this country has had its share of trouble from this source, has recently developed a method of curing the condition that, while considerably at variance with the generally accepted methods, has met with marked success.

For a number of years the track on the Carthage subdivision of the Northern division of this road had given a great deal of trouble from soft spots. Even moderate rains caused it to get badly out of line and surface, so that frequently an excessive amount of work was required to keep it in passable riding condition. Additional ballast, out-of-face surfacing and cleaning and deepening the surface ditches had no appreciable effect. Tile drains and French drains, installed in accordance with the most approved practice, were also tried with an equal lack of success. These gave temporary relief, but were complete failures so far as permanent improvement of the conditions was concerned.

What the Study Disclosed

The situation finally became so troublesome that an intensive study was undertaken with a view to developing a remedy which would be both inexpensive and effective. This study disclosed that, in general, the soil consists of what is known locally as post-oak clay, which is incapable of supporting heavy unit loads. The grade line is quite irregular, following very closely the natural surface of the rolling prairie country, but with many grades so light that ordinary forms of subsurface drainage are not practical.

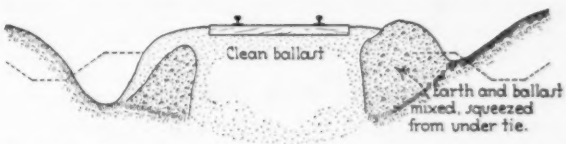
For many years after the line was constructed no ballast was used, the surfacing having been done with the natural earth. Later, as soft spots began to appear, the track forces collected field stones which they broke up with knapping hammers and placed under the track. After the field stone, hand jigged chatts, cinders and, in some places, small boulders were applied successively. Finally, for a number of years preceding the investigation, rather large quantities of chatts had been used.

During this latter period efforts were directed toward maintaining good side ditches, placing them as close to the track as was considered safe and, frequently, deepening them as much as three or four feet in an attempt to provide ample drainage for the ballast and subgrade. In almost every case, the mixed clay and ballast which was squeezed out from the roadbed, and which accumulated between the ends of the ties and the ditch was removed frequently, to avoid any chance of blocking the drainage. Additional chatts was unloaded from time to time to replace the material thus removed, so that at almost every place where soft spots were examined a deep heavy bed of ballast was found below the ties.

In addition to this heavy bed of clean or nearly clean ballast, which is shown in the drawing, a body of material was found which extended from three to six feet beyond the ends of the ties, and which was composed of clay and ballast more or less intimately mixed. It was definitely established that this mixed material originated under the track and just below the bottom of the ballast, the plastic clay at this point allowing the ballast to settle into it and then flow away as the moving loads were applied through the track structure during the passage of trains.

Coarse Material a Detriment

It was interesting to note that the coarse rock that should have remained below the ballast had all worked to the extreme top of the squeezed material, which confirms the experience of many other maintenance men who have tried coarse stone for a similar purpose, that coarse material is not adapted for use on a soft roadbed. The reason for this is that material is required that will act as a blanket rather than to penetrate the soft stratum.



Typical Conditions Under Track at Water Pocket as Disclosed by Borings

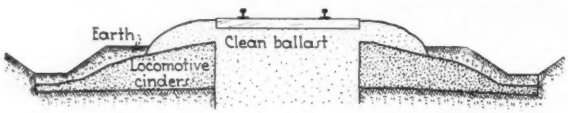
This mixture of ballast and clay, which squeezed up and reached the surface beyond the ends of the ties, was extremely hard and difficult to remove, even with picks. It was also found to be impervious to water, thus demonstrating the reason why the surface ditches had been found ineffective, regardless of their depth or proximity to the track. Since the water which reached the track from any source was held in the ballast, a vicious circle was created, for the reason that, as the already saturated clay flowed out from under the ballast bed, a new surface was immediately exposed to the same action.

The investigation also disclosed that the depth of

the ballast ranged from four to six feet below the ties and yet that the clean ballast, the only material capable of transmitting the load to the roadbed, had a maximum spread of only nine or ten feet. This indicated a unit loading of the subgrade very much in excess of what it should be. One of the problems facing the maintenance officers of the division, then, was to devise means for providing a greater spread of selected ballast material over the subgrade.

Subsurface Drainage Impractical

The depth of the clean ballast was such that to provide complete subsurface drainage was out of the question from a physical standpoint, as well as because of the cost involved. While it is desirable to provide drainage for water pockets of such a depth and character that no water will be left in the roadbed, experience has shown that in many places when no trouble occurs from soft track, the roadbed is holding water in considerable quantities, which will



Typical Section of Completed Roadbed

run off if it is tapped by drains. This led to the conclusion that a certain amount of water can be tolerated in the ballast without injury to the track and that, therefore, imperfect drainage does not of necessity mean soft roadbed.

Experience has also shown that, while drainage usually cures and always reduces the trouble, some pieces of soft track cannot be cured entirely, even by complete drainage. It was reasoned, therefore, that in some instances the trouble does not originate in inadequate drainage but rather in the unstable character of the soil of the roadbed, and that lack of drainage merely aggravates the condition thus created. The further conclusion was then drawn that the desired results might be obtained by improving both the drainage and the character of the foundation without attempting to approach perfection in either.

How the Work Was Done

The plan which was evolved was based on this line of reasoning, and the facts disclosed by the study of the physical situation. The first operation consisted of the construction of side ditches having the contour of the railway's standard ditch and of sufficient depth to care for the normal amount of surface water. Considerable care was exercised in preparing the plans for these ditches, since it was desired to provide for heavy run-off through additional width rather than by means of greater depth, because the deeper the ditch the less support it would give to the plastic material.

The next step was to remove to a depth of two to four feet below the bottom of the tie, all material from the shoulder that showed any signs of squeezing, or until soil was exposed that showed no evidence of having flowed. Only in rare instances was objectionable material found directly under the ties. When this did occur it was removed in the same manner.

After the excavation of the shoulder was completed, locomotive ashes were unloaded and spread into the position shown in the second drawing. The ballast was then dressed to the road's standard section and earth was placed over the cinders outside the ballast toe line to form a shoulder for the subgrade. At the same time the ditch was restored, if it had been disturbed by the excavation of the shoulder. The job was then completed by giving the track a good line and surface.

In doing the work, no attempt was made to drain the water from under the track or lead it into the side ditches. The reason for this was that, in almost every case, the natural slope of the ground and the gradient of the track were such that an outlet for either surface or subsurface drainage to this depth could be secured only at excessive cost. Besides this, it was believed that the open ditch of the necessary depth would decrease the side support enough to prevent the stabilized condition that was sought.

It was found that the unit cost of the work varied between wide limits, but that it was influenced by the depth of the squeeze, the height of the embankment or depth and width of cut, the amount of moisture contained in the roadbed, the condition and depth of the existing ditches, and the amount of track work that was required. Without exception, however, this cost was only a fraction of what would have been necessary if complete drainage had been installed.

Underlying Principles of the Plan

It has been established that the success of this plan depends primarily upon the prompt and complete run-off of the surface water. It seems certain that without this, proper results cannot be obtained. Another matter already mentioned, but which requires emphasis, is that coarse ballast materials should not be used where the roadbed shows a tendency to develop soft spots for instead of forming a strong, firm support, such ballast tends to penetrate the unstable material upon which it rests, thus starting a flowing action, which aggravates rather than reduces the squeezing.

The filling of the deep ditches, the removal of the side ditches to the standard distance from the track, and the absence of subsurface drainage constitute a radical departure from the generally accepted practice of curing soft spots. The experience on this line, however, indicated the need of side support for the unstable roadbed. The continued removal of the squeezed material, instead of allowing freer drainage of the water confined in the ballast, merely provided an opportunity for more of the plastic material under the ballast to squeeze out, thus deepening the water pocket.

Probably the most radical departure from generally accepted principles is the theory upon which the plan is based, that it is not necessary to have open drainage from the bottom of the water pocket in order to effect a permanent cure or even to stop the progress of the squeezing. From the experience gained in this case, it is quite evident that while such drainage is always desirable, it is not an absolute necessity. Where complete drainage is not practical and it can be compensated for by an improvement in foundation conditions, the desired results will follow.

It is not contended that this plan has a universal application. Different localities present different problems, each of which can be solved only after a complete knowledge of the facts is obtained. It is believed, however, that the reasoning which led to the evolution of the plan is sound and that with some modifications to meet local conditions, this method can be adapted to most situations.

One of the First Concrete Block Tool Houses on the Delaware & Hudson

Builds Tool Houses of Concrete Blocks

Delaware & Hudson finds this type of construction offers advantages over frame structures and costs no more

RECOGNIZING the value of neat-appearing and orderly-arranged section tool houses, the Delaware & Hudson has been giving special attention to this type of structure during the last few years, and is now providing tool houses which are not only neat in appearance, but which also embody permanent and fire-proof construction. Furthermore, the new standard house is so arranged and equipped as to foster orderliness and cleanliness, and combines all of these features in a unit which costs no more than the tool houses of lesser merit which have been used on the D. & H. in the past.

The new type of house, the first of which was constructed in 1926, is of concrete block construction with a frame roof with overhanging eaves, protected by slate shingles and copper ridge and flashing. An unusual feature of this construction is the fact that both the blocks and the slate are in the standard colors of the railway company.

The houses are in two styles, single and double, the single house having outside dimensions of 21 ft. by 16 ft., while the double house is 42 ft. by 16 ft. Each single house and each section of a double house are provided with three large sectional, side-hinged windows and a wide door which rolls sidewise on an overhead trolley track. Both the window sash and the door are of wood while the lintels and sills of the door and windows are precast reinforced concrete units.

The houses are set back 12 ft. 4¼ in. from the center line of the nearest track to the edge of the eaves and rest on eight poured-in-place concrete footings, with concrete beams, reinforced with scrap 90-lb. rail, extending between them to carry the weight of the end and side walls. The floor is usually of cinders, but two of the houses, one single and one double, are provided with four-inch concrete floors. The new houses have a motor-car track of scrap rail, which is sloped away from the operating track to preclude the possibility of a car rolling out of the house of its own accord.

Heating of the houses is by the usual type of coal-burning stoves, and ordinarily no provision is made for artificial illumination other than by lanterns. However, the one double house already constructed, which is located at West Waterford, N. Y., is equipped with an Arcola hot-water heating system, and with electric lights. The heating system at this house is experimental in character, and while efficient in itself, there is some doubt as to its practicability for tool-house heating where one of the most important requisites of a heating system is quick heat.

Houses Are in Standard Colors

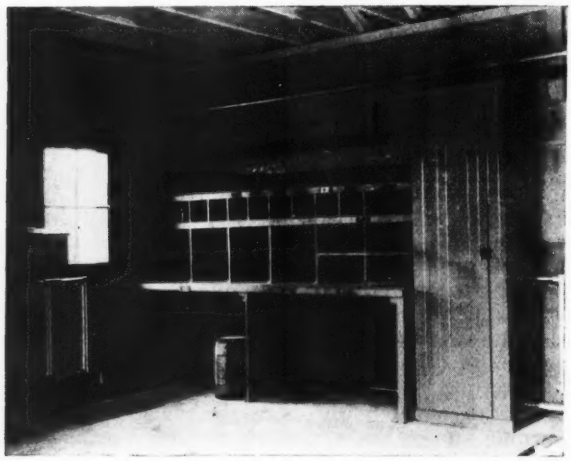
While, in themselves, the new standard concrete-block section tool houses have points of merit, just as have houses constructed of other types of permanent and fire-proof materials, the selection of the particular type of construction adopted by the D. & H. was influenced primarily by the availability of the materials used and the economy of construction and maintenance. In the first place, the concrete blocks are manufactured by the Chateaugay Ore & Iron Company, a subsidiary of the D. & H., located at Lyon Mountain, N. Y., about 200 miles north of Albany on the Chateaugay branch of the D. & H.,

and in the second place, the slate used in the roof construction is readily available at numerous points along a branch line of the D. & H. extending into Vermont.

The concrete blocks are made with iron ore sand, and the coloring matter is used in the material forming the face or faces of the blocks to be exposed, so as to improve their appearance and give the finished structure the standard colors of the railroad. In an effort to improve on the appearance of the ordinary unfinished concrete block, the outside exposed faces of the blocks are given a uniformly grooved finish, which is provided for in the block molds. The two colors used are olive gray and dark green, the former being used in the main body of the house, while the latter is used in the trim blocks at the corners. All of the blocks are laid up with a gray cement mortar. The slate in the roof construction is sea green in color, and the concrete sills and lintels, as well as the door and window sash, are colored dark green, to match the general color scheme.

Interior Finish

The interiors of the new tool houses are painted throughout; the base course, five blocks high, being finished in a dark gray, and the remainder of the walls in a relatively light gray. The roof beams and rafters are also painted gray, but even lighter in color than the gray used on the upper sections of the walls. All interior furnishings of the new houses, such as bins, racks, etc., conform to standards adopted for all tool houses on the D. & H., and are painted a dark gray, similar to that of the base course.

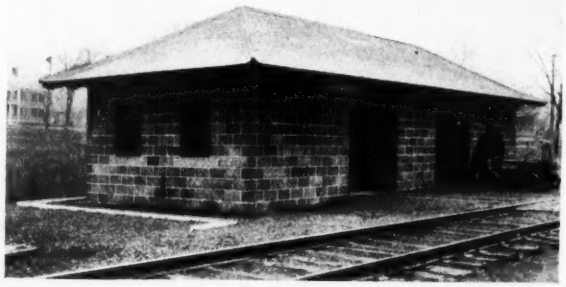


This House Has a Concrete Floor, Electric Lights and a Hot-Water Heating System

The principal items in the bill of materials for the new single concrete-block section tool house are included in the following:

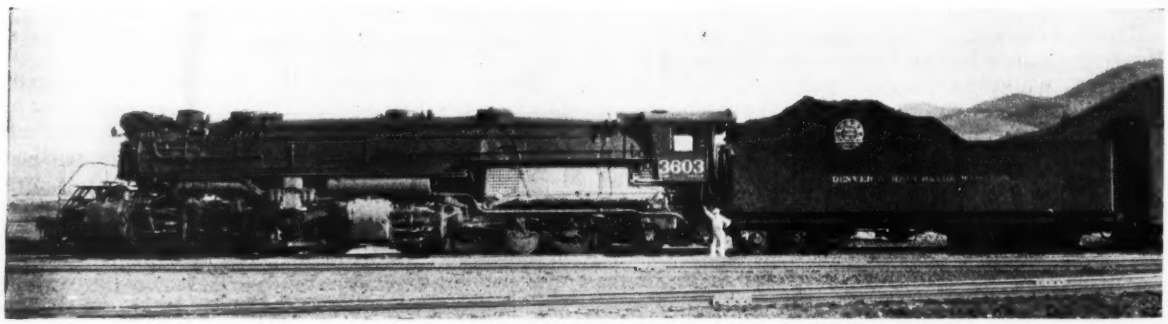
473 full blocks, body color, 15¾ in. by 7¾ in. by 8 in.
24 half blocks, body color, 7¾ in. by 7¾ in. by 8 in.
94 full blocks, trim color, 15¾ in. by 7¾ in. by 8 in.
56 full blocks, trim color, 15¾ in. by 7¾ in. by 8 in.
2 half blocks, trim color, 7¾ in. by 7¾ in. by 8 ft.
8 precast slabs, trim color, 3 ft. 11¾ in. by 7¾ in. by 8 in.
1 precast slab, trim color, 7 ft. 11¾ in. by 7¾ in. by 8 in.
7 squares of green slate roof.
600 ft. b.m., 2-in. by 6-in. tie-beams and rafters.
50 2-in. by 6-in. false rafters.
750 ft. b.m. hemlock roof boards.
1 6-ft. 5-in. by 7-ft. double-ply sliding door.
3 sectional windows.
8 gal. of Cementex (inside on blocks).
4 gal. white lead paint.

The new standard section tool house replaces a former standard house of frame construction, and is thought to offer a number of advantages over the old style house, primarily with respect to its features of appearance, permanence and fire-proof character. No upkeep is expected in connection with the new type house, and yet it is felt that it will long out-last the old style frame tool house that receives only the amount of attention ordinarily given to that type of structure.



The Double Tool Houses Present an Unusually Sturdy but Pleasing Appearance

Owing to the availability of materials and the ease with which the new houses can be constructed, without special framing or falsework, all of the advantageous features of the new type of house are being secured with an initial expense, which, if anything, is less than that required for the construction of the old style standard house. The new type house, which will replace the older houses only as conditions require, is erected by the building forces of the road under the general direction of H. S. Clarke, engineer maintenance of way.



Articulated Locomotive on the Denver & Rio Grande Western

Handling Ties With Safety

Section foremen on Missouri-Kansas-Texas outline their practices in carrying on this work to avoid injury to their men

THERE ARE many chances of injury to trackmen in handling ties, either when unloading them from cars or in placing them in track. In order to obtain a representative cross-section of the methods employed to guard against injuries in this work, F. M. Thomson, district engineer on the Missouri-Kansas-Texas, with headquarters at Denison, Tex., sent a letter to one section foreman on each of four roadmaster's districts, asking them to outline their practices in handling these tasks. Abstracts from the replies are given below:

Hands Should Be Kept From in Front of Ties

By R. E. RENFRO
Foreman, Section 114, Henrietta, Tex.

In unloading ties from coal cars, the man working next to the side of the car from which they are being unloaded should take hold of the tie about 18 in. from the forward end to raise it and place it on the side of the car without running the risk of injuring his hands or arms. He should then step back and let the man at the other end of the tie push it over the side of the car. If the ties are pre-adzed, the dapped side should be placed upward, since if this is not done the dap may catch on the side of the car and cause the man who is shoving it to fall, or it may cause the tie to swing to one side. If tie tongs are used, they shqulld be kept sharp to prevent their slipping out of the wood. The tongs should be applied at a point near the bottom and at about the center of the tie lengthwise and should be gripped tightly together.

When unloading ties from box cars or stock cars, one man should pull the tie carefully from the stack, while another man holds the end securely to prevent it from falling. When the tie is carried to the door to be thrown out of the car, the man at the forward end should stop about three feet from the center of the car door to avoid the possibility of the tie swinging around and hitting him as it is thrown out.

When inserting ties in track, they should not be carried or lifted by one man when they are being placed where they are to be used. Tie tongs in good condition and with sharp points should be used for dragging the ties into place.

If these methods are followed, I believe that our personal injury ratio will be considerably lower than it has been in the past.

Team Work Is Necessary

By V. E. LAUDERDALE
Foreman, Section 317, Forreston, Tex.

Nearly all of the accidents, minor as well as major, caused by handling ties can be avoided by a little advance planning. The men should be taught to practice team work and the man in charge should know just what he wants done, and impress it on his men to minimize confusion. Our ties are now treated with creosote and are often distributed from cars freshly loaded at the treating plant, while still dripping with oil. Obviously more care must be exercised in handling these ties than if they were dry, because of their slippery condition and also because of their greater weight.

In unloading ties from gondola cars, three men should work as a unit, two men standing on the side of the car from which the ties are being unloaded to lift the end of the tie and place it on the side of the car, after which a man at the other end shoves the tie over the side. In handling machine-adzed ties, they will slide much better if the adzed face is turned up. Timber hooks, such as are used by bridge men, or tie tongs, well sharpened, are useful for lifting the ties, and cotton hooks have also been used successfully.

The foreman should place himself where he can

observe movements of the train which may cause the ties to shift and any other conditions which will affect the work or the safety of the men. Holes in the floor of the car are sometimes patched with boards or pieces of sheet metal and these should be watched for, to see that they are in condition to afford a safe footing. When ties are shipped in box cars, which is seldom done now, both doors should be opened wide for ventilation for 24 hours before unloading is begun, if possible.

Four men should be used in distributing ties with a push car. After the car is loaded and moved to the place of unloading, two men should be stationed on each side, one at each end of the car. Two of these men should control the movement of the car and one of the men at each end of the car should push a tie over so that it is about half off of the car, for the man on the other side to grasp and pull off at the proper place. If the ties are in more than one tier, each should be rolled down to the floor of the car and moved clear of the other ties before being unloaded, to afford a better hand hold without danger of mashing the fingers and also to give a better view of any slivers. In pulling the ties off of the car, the two men should watch out for each other to avoid a tie being dropped on the heels of the forward man or on the toes of the man to the rear.

When inserting ties, the tongs should be kept sharp enough to hold the ties firmly. When pulling with the tongs, a man should stand in a lifting as well as a pulling position, with his feet apart, so that he can recover his balance if the tongs slip. If a rough place catches on the under side of the rail, the tie should be shoved into place with a lining bar the end of which has been forced into the ground or ballast at the end of the tie.

In pulling old ties out of track with a pick, one must be sure to see that the pick has a firm hold, as some nasty falls have been caused by the pick coming out of the tie during a hard pull. In carrying old ties the hold should be made on sound timber, otherwise a piece may break out, allowing the tie to fall.

In putting on tie plates, one should not put his hand under the rail to clean off the bearing on the tie, as the jack might slip. Each man should be taught how to hold a spike to be started with a blow of the maul and should never allow his fingers to get between the spike and the rail.

Skin Should Be Protected From Creosote

By J. B. Wilson
Foreman, Section 200, Denison, Tex.

In handling creosoted ties, I have the men rub grease or vaseline into the skin of their faces and arms to prevent irritation and blistering from the creosote. Before starting the work, I always caution them to use care not to injure themselves or others. I get into the car with the men to assist them in rolling the ties from the top tiers, directing the work to see that one man does not roll or turn a tie in such a manner as to injure the other men. In this work, I pay special attention to the new men in the gang.

In unloading ties from coal cars, one man frequently can throw the ties from the top tier and two men to the tie are sufficient until the tiers are well below the top of the car. For the ties near the bottom of the car, three men are used; two at one end to raise the tie and place it on the side of the car, while the third man, at the other end, gives it a boost to throw it off the car.

In placing ties in track, I allow only one man to the tie and space them not less than a half rail length apart, cautioning them not to strike glancing blows with their tools toward the other men to avoid injury in case the tools should slip from their hands.

The main thing in handling ties safely is to have a system, followed by close and detailed supervision by the foreman. I have used the methods outlined and do not recall that I have ever had a man injured in this work.

Use Tongs When Unloading From Coal Cars

By C. J. Tisdell*
Foreman, Section 101, Woodbine, Tex.

Before starting the work the men should be instructed as to the way it is to be done. In unloading ties from coal cars, three men should work together and not more than three sets of men should work in one car. Two men should handle one end of the tie with a pair of tongs, applying them about a foot from the end and raising the tie to place it on the side of the car so that it extends from 8 to 10 inches beyond the car. The tongs should then be released and reapplied near the center of the tie to assist the man at the other end in shoving it over the side. When the tie has been pushed about half way over the side one of the tong men, who has been designated for the purpose, should release the tongs, and then the man at the rear should lift up his end, allowing the tie to fall to the outside, clear of the train.

In unloading from box cars, six men should work in one car; one man in each end of the car to push the ties out to be carried to the door by two men. In carrying the ties, the forward man holds one end of the tie while the man at the rear holds the tie about two feet from the end. When the door is reached the forward man throws his end out of the door and steps back into clear, after which the rear man releases his hold on the tie. Tie tongs should not be used in unloading from box cars and two ties should not be thrown from the same door at the same time.

When an old tie has been removed from the track and the hole is ready for inserting the new tie, one man with a pair of tongs should pull the tie into place while another man holds up the other end of the tie with a pair of tongs. The men should be careful to see that they have a good footing and that the tongs have a good hold before pulling hard. Both feet should never be placed on the rail and the tongs jerked. The tongs should be inspected frequently to see that they are in good condition.

*Mr. Tisdell was recently promoted to roadmaster, with headquarters at Denison, Tex.

A Locomotive Crane Handling Scrap on the Pennsylvania at Verona, Pa.

Uses Acid to

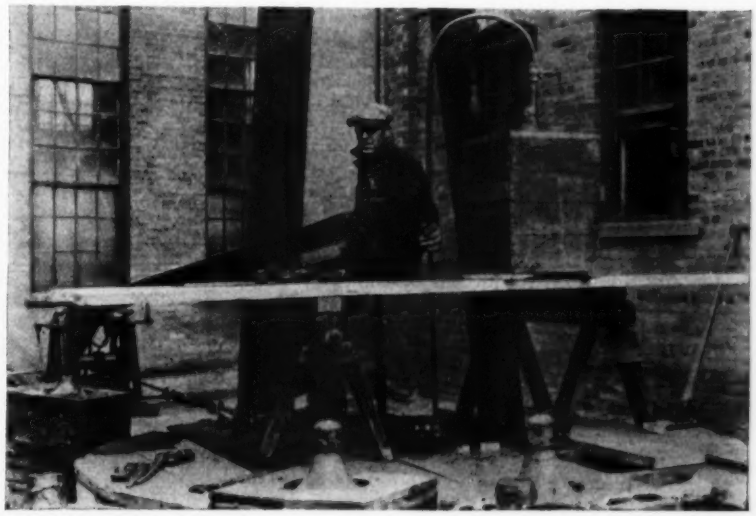
Clean Well Screen

Flow at Jamestown, N. D., restored in 20 hours with 1000 gal. of chemical at a cost of $73

By E. M. GRIME
Engineer of Water Service, Northern Pacific, St. Paul, Minn.

THE original rate of flow of a 12-in. drilled well, which had been greatly reduced by incrustation of the screen, was fully restored on the Northern Pacific recently by cleaning the screen with commercial hydrochloric acid. The well is situated at Jamestown, N. D., which is an important terminal point, requiring, under ordinary conditions, 600,000 gal. of water each 24 hours. The water supply comes from a water-bearing stratum of gravel, 17 ft. thick. The well is 100 ft. deep and the water enters through a brass screen, 15 ft. long, located in the gravel.

The static water level is 11 ft. below the natural ground surface, and when the well was first drilled it produced a flow of 613 g.p.m. with the water level drawn to 21.2 ft. below the surface. It was possible to speed up the test pump to produce 693 g.p.m., at which rate the water level dropped only 0.1 ft. farther, indicating a free flow at this elevation. During the last three years, pumping has been at the rate of 500 g.p.m., this being the normal capacity of the water-softening plant.



Showing the Arrangement of the Syphon and a Carboy Over the Well

This water does not vary greatly in chemical content and a fair average analysis is as follows:

Oxides of silica, iron and aluminum	Trace
Carbonates of calcium and magnesium	21.0 gr. per gal.
Alkali chlorides	3.8 gr. per gal.
Alkali sulphates	20.5 gr. per gal.
Alkali carbonates	3.0 gr. per gal.
Total	48.3 gr. per gal.

The pumping rate of 500 g.p.m. was maintained until June, 1929, when it was noticed that the flow had dropped to 436 g.p.m. The flow continued to decrease and on July 24, a test showed it to be only 364 g.p.m., or 69 per cent of actual requirements. It was also noticed that the water level while the pump was running had dropped from the normal level of 21.2 ft. below the surface to 34 ft.

No Damage to Screen

The city of Jamestown also secures its water supply from the same water-bearing stratum, and investigation at this plant, which is located about one mile distant, indicated that there had been no appreciable dropping of the ground-water level. It was also noticed that if the railroad pumping plant was closed down for a sufficient period, the water in the well would gradually rise to the original ground-water level.

From these data, it was concluded that the decrease in the capacity of the well was due to incrustation of the screen. While the carbonates of calcium and magnesium shown in the analysis are normally in the bicarbonate form and should not form incrustation, it appeared that there must be some breaking down to the normal carbonate form, due, possibly, to the agitation and difference in pressure created at the screen when the water is drawn rapidly through it. If this were true, a slow but steady accumulation of the carbonates of calcium and magnesium would take place which would finally close all the screen openings. Accumulations of this kind of incrustation have been known to build up solidly all around a screen to a thickness of ½ in. or more, closing off the water and making it practically impossible to remove the screen without drilling it out.

Hydrochloric Acid the Cleaning Agent

Laboratory experiments indicate that, whereas concentrated hydrochloric acid will readily attack carbonate incrustation, it has little effect on yellow brass of which the well screen is composed. It was, therefore, decided to attempt to clean the screen by means of hydrochloric acid. The 12-in. screen section, 15 ft. long, holds approximately 88 gal. The highest gravity commercial hydrochloric acid has a specific gravity of 1.2 and, therefore, weighs practically 10

lb. per gal., requiring 880 lb. to fill the screen. To allow for waste or other losses, 1,000 lb. of acid was provided, with the idea of filling the entire length of the screen.

To apply the acid, a 1¼-in. black iron pipe was run down to the bottom of the well and then raised three inches to give a free outlet for the acid. The acid was received in nine 112-lb. carboys, and, to avoid personal injury when pouring, a ¾-in. copper pipe syphon was provided. The short end of the syphon projected to the bottom of the carboy and the long end entered a funnel at the top of the 1¼-in. delivery pipe.

The syphon was equipped with globe valves about 24 in. from each end and with an air vent and plug just below the upper valve, making it possible by manipulation of the valves to avoid spilling acid or breaking the syphon while changing carboys. It was thus possible to keep the flow of acid descending rapidly, with the idea of completely filling the screen to secure complete action over the entire surface before much of the acid could disappear through screen holes which might be opened up near the bottom as soon as the acid reached them.

Simultaneously with the pouring of the acid, a volume of water equal to that of the acid was removed from the top of the well pipe by means of an ordinary cistern pump, to avoid any circulation or mixing of water and acid at the bottom of the well. The idea was to have the concentrated acid rise steadily to the top of the screen, forcing the water upward, and leaving the acid to eat its way through the carbonate incrustation. The iron pipe was raised sufficiently, as soon as the pouring of the acid was completed, to be above the acid line. In a short time, violent agitation of the water surface indicated that chemical action was taking place, and carbon dioxide gas, formed by the action of the acid on the carbonates, soon filled the base of the six-foot open pit which surrounds the top of the well. This gas accumulated to a depth of two feet, as indicated by the failure of a torch to remain burning below this level.

The Well Back to Normal

After the acid had been poured, the well was allowed to remain undisturbed for 20 hours. Bubbling of the gas from the top of the well continued, but at a gradually decreasing rate, and by the end of the period had practically ceased. An air pipe was then dropped to the bottom of the well and the water and acid violently agitated to bring up that at the bottom. Field tests of this water indicated that it was only slightly acid or about six per cent of a normal acid solution. Concentrated acid does not rapidly diffuse into water when there is no circulation and, evidently, it had effectively spent its strength in dissolving the carbonate incrustation in this case.

After the drop pipe had been replaced, a test showed a flow of 505 g.p.m., as compared with the previous flow of 346 g.p.m. Subsequent tests have shown a slight increase in this flow, and the water level, while the pump is running, stands at practically the same elevation as when the well was new, thus indicating a return to almost normal conditions.

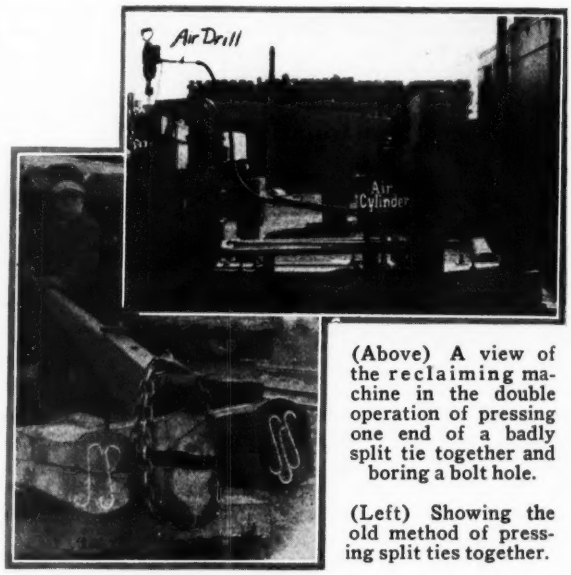
The cost of the acid was $23 and the labor involved for removal and replacement of the well pipe was about $50, making a total expense of approximately $73. Prior to making this experiment, it had been roughly estimated that it would cost at least $500 to engage a well driller, for the purpose of removing the old screen and placing a new one.

Split Ties Reclaimed By Air-Operated Device

By Andrew Gibson
Superintendent Timber Preserving and Tie Treating Plants, Northern Pacific, Brainerd, Minn.

TO PRESS the ends of badly split ties together so that S-irons or bolts may be applied, the Northern Pacific has developed a device which consists essentially of a pivoted lever, one end of which is operated by compressed air, forcing the other end down and against the defective tie, which rests on a substantial wood platform, the whole being constructed of scrap material and mounted on a heavy wood frame. Compressed air is also utilized to operate an air drill for boring bolt holes, this work having formerly been done by an ordinary ½-in. auger. By means of this device, the labor of reclaiming these ties has been reduced more than half.

Large numbers of treated ties of maple, red oak, elm and beech are used by this road and it has been found that, in the process of seasoning, these ties



(Above) A view of the reclaiming machine in the double operation of pressing one end of a badly split tie together and boring a bolt hole.

(Left) Showing the old method of pressing split ties together.

check badly, sometimes to the extent that S-irons or other similar devices are not adequate to hold them together in a usable condition, and it is necessary to apply bolts for this purpose. An effort is made to apply S-irons to all ties that show the slightest indication of checking, before they are stacked for seasoning, but a small percentage check in the piles where they cannot be conveniently reclaimed, and, therefore, no remedy is applied until they are taken to the boring and adzing machine, where it has been found that approximately 1½ per cent of the ties require bolting. The bolts, nuts and washers which are used are salvaged from scrap material by the foreman in charge of the reclamation dock, who knows the kind and size of material needed and lays aside all that can be used at the tie plant when a carload of scrap reaches his hands.

Prior to the development of this device, these ties were reclaimed by means of a lever and chain, with which equipment it was found that three men could not reclaim more than 50 ties in an eight-hour day. With the new device, however, two men can reclaim 100 or more ties, depending on the grade, in the same

time. With two bolts to a tie, one at each end, the necessary bolts, nuts and washers cost 10 cents a tie and the labor 6.75 cents. Thus, by the expenditure of 16.75 cents, a tie costing $1 and which otherwise would either be discarded or used in an unimportant track, is placed in a condition suitable for use under heavy traffic.

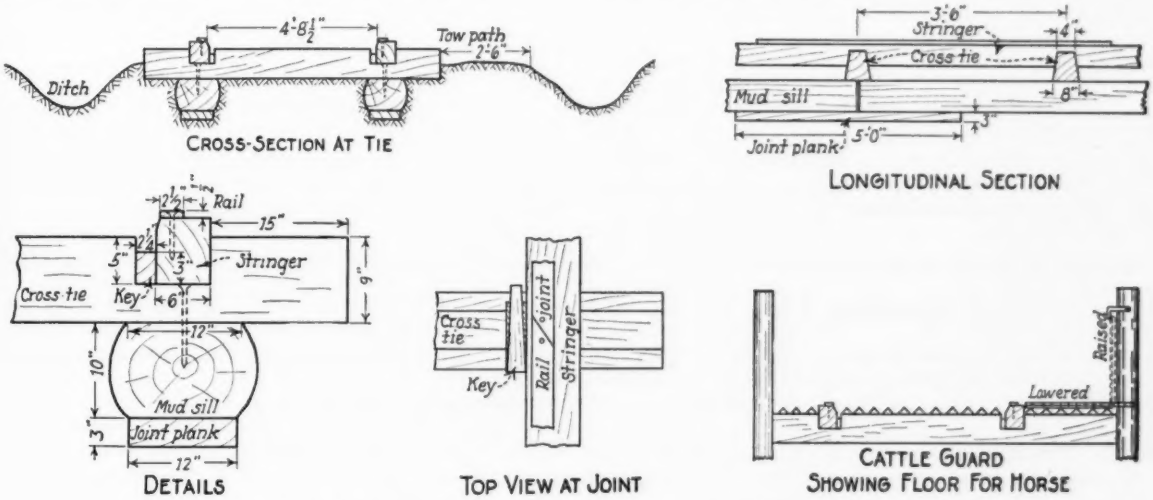
Main Line Track of 80 Years Ago

A SHORT section of wood track, constructed about 1846, and contrasting strongly with its counterpart of the present day, was unearthed by employees of the Michigan Central at Jackson, Mich., a short time ago. This track was part of the original line of this road between Detroit, Mich., and Kalamazoo and was of all-wood construction with the exception of the strap-like metal rails, that in reality functioned only as a wearing surface for wood stringers which carried all the stresses to which the rails were subjected.

The inner edge of the stringers, along which the ½-in. by 2½-in. rails were laid, was beveled a small amount, presumably to reduce the probability of splitting or crushing. Countersunk holes were bored at proper intervals in the rails, through which spikes were driven into the stringers. The ends of the rails were mitered and no connection was provided between them, although a spike was driven near the end to prevent the rail from turning up at that point. This method of fastening, however, did not prove sufficient, as the spikes sometimes worked loose under traffic, allowing the pointed ends to project upward. Not infrequently this occurred to such an extent that a wheel passed under the end of the rail, forcing it upward and through the floor of the car, thereby endangering the lives of passengers and occasionally derailing the train. When the rail turned up in this fashion it was called a "snake head."

Some Traffic Was Horse Drawn

That all power was not furnished by steam in those days is revealed by the presence of a tow path along one side of the track, which gives evidence that the



Details of the Track Construction Taken from an Old Blue Print

This track consisted of two parallel lines of longitudinal mudsills, placed the gage distance apart and supporting ties, spaced 3 ft. 6 in., which in turn carried the stringers with their wearing surface of thin metal strap.

The Mudsills Were Hewed

The mudsills were of timbers taken from the nearby forest and were about 10 in. thick, after being roughly flattened on their upper and lower surfaces to provide a proper bearing for the ties and to make possible a firm connection by means of joint planks. These planks were 3-in. by 12-in. by 5-ft. timbers spiked to the bottoms of adjoining mudsills to form butt joints. Crosswise with the mudsills and fastened to them by long spikes came the crossties of a peculiar tapering shape, approximately 8 ft. long and tapering from a width of 8 in. at the bottom to 4 in. at the top. They were dapped to a depth of 5 in. and a width of 8¼ in., to accommodate the 6-in. by 7-in. stringers which were held in place only by a wood key, 9 in. long and 3 in. high and tapering from a width of 2¼ in. at one end to 1½ in. at the other. This key was forced tightly into place between the gage side of the stringer and the side of the groove.

trains were at times drawn by horses. Each cattle guard was provided with a movable walkway which was ordinarily fastened in a vertical position but which was lowered onto the cattle guard, at the approach of a horse-drawn train, to make it possible for the horses to cross over.

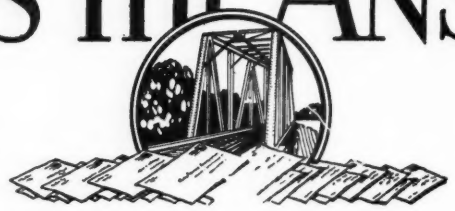
In the construction of the 145 miles of the original line of the Michigan Central between Detroit and Kalamazoo, approximately 43,000,000 ft. b.m. of timber was used. We are indebted for the information appearing in this article to J. S. Huntoon, assistant bridge engineer of the Michigan Central at Detroit, Mich.

The Railway Industry at a Glance

Operating revenues and expenses of the Class I steam railways in the United States, from data compiled by the Bureau of Statistics, Interstate Commerce Commission:

	Month of January 1930	1929	Decrease 1930 Under 1929
Total operating revenues	$451,190,494	$487,462,520	7.4%
Expenditure for maintenance of way and structures	54,833,265	58,418,686	6.1%
Total operating expenses	356,468,702	369,737,657	3.6%
Net railway operating income	55,474,415	77,175,938	28.2%

WHAT'S THE ANSWER?



Have you a question you would like to have someone answer?

Have you an answer to any of the questions listed below?

QUESTIONS TO BE ANSWERED IN THE JUNE ISSUE

1. What causes the wing rails of spring frogs to break opposite the frog point more frequently than elsewhere? What means can be employed to prevent this?

2. Where it is necessary to place intermediate bents under a steel span, what precautions, if any, should be taken?

3. What, if any, advantage results from painting galvanized sheets used as roofing or siding on railway buildings? How should the surface be prepared for painting?

4. What provision, if any, should be made for the inspection of water stations at regular intervals? By whom should this be done and what details should receive most consideration?

5. Should anti-creepers be spaced uniformly throughout the rail length or grouped at certain points in the panel? Why?

6. What are the relative advantages of side and center dump cars for distributing ballast for ordinary reballasting operations?

7. What precautions, if any, are required in maintaining track where 39-ft. rails are used, that were not necessary with 30-ft. or 33-ft. rails?

8. Under what conditions is it advantageous to erect steel bridges of moderate span by company forces? Under what form of organization?

Unloading Ties

How should a section gang of from six to eight men be organized in unloading ties from stock or box cars, from the standpoints of efficiency and safety?

The Proper Organization Is Important

By A. D. HENNINGER
Section Foreman, Minneapolis, St. Paul & Saulte Ste. Marie, Moose Lake, Minn.

The proper organization of a gang for unloading ties is important from the standpoint of both safety and efficiency. When unloading from box or stock cars, two or three men per car are sufficient. When using a group of six or eight men, the work should be prearranged as much as possible, so that the ties may be unloaded in groups of two cars, which permits leaving two men behind the train to follow with the motor car and throw out ties which do not properly clear the track. In dividing the gang for this purpose, care should be taken to place at least one of the most experienced men in charge of each group, who will watch for their safety, as well as see that they work with the proper precision.

If, for any reason, it becomes desirable to put two groups in a single car it is important that their movements be timed so that one group does not interfere with the other when in the act of drawing out the ties and that the men keep back out of the way of any possible rebound.

Speed not only reduces the economy of the operation but increases the possibility of injury, for the reason that when the men are working too fast they often disregard the rules of safety and pinched fingers, broken limbs or other injuries result. If a sufficient number of ties are not being unloaded over any given stretch of track, the speed of the train should should be reduced rather than the speed of the men increased.

When the tie train is run at too great a speed, it is difficult for the men to drop the ties properly from the car and, on high banks many of them will roll down to the bottom of the embankment, which means that unremunerative time must be employed to get them back to their proper place; besides, there is an added element of danger of personal injury.

In the interest of safety, the men should not be allowed to unload from both ends of the car at the same time but all should work from one end. After the center has been cleared the upper tiers from the end which is not to be worked at first can be taken down. This method of unloading decreases the danger of men bumping into each other. Care should always be taken to work the ties from the top of the piles and not to complete a tier before the next one is touched, otherwise a slight jerk of the train may cause those on top of the pile to fall off and injure the men despite any other precautions they may take.

It is also important that they use care in unloading the ties to insure that they will fall with the movement of the train. If they are allowed to fall against the movement of the train it frequently occurs that they swing back over the rail and derail the car.

Organization Depends on Local Conditions

By G. M. O'ROURKE
District Engineer, Illinois Central, Waterloo, Iowa

In my opinion, it is not practicable to fix the organization of a gang which is assigned to the work of unloading ties from stock or box cars, for all cars

are not loaded alike. For this reason, the conditions that a foreman has to meet when he is called upon to unload a car of ties may differ widely from those he has already met. Furthermore, the organization which is best for unloading ties from cars standing on station grounds may not be adapted for unloading from cars that are moving continuously or which move from spot to spot out on the line.

My opinion is that the organization of the forces for unloading ties should be left to the section foreman, under the guidance and check of the track supervisor. If these men are interested in their work they will organize for efficiency and safety. If they do not, the fact will be very quickly discovered by their superior officers.

Platforms in Coach Yards

What are the relative advantages of wood block, brick, bituminous compounds and concrete for platforms in coach yards, from the standpoint of maintenance? Should the curbs be flush with or higher than the platform?

Concrete Is Most Satisfactory

By Irving Anderson
Division Engineer, Atchison, Topeka & Santa Fe, Kansas City, Mo.

Coach yard platforms should be constructed of material that will allow the economical maintenance of a clean and smooth surface. If wood blocks are used but not placed on a concrete base, they are subject to heaving on account of frost, and always to expansion on account of moisture and heat. It is practically impossible to keep moisture out of wood block paving and, when wet, any application of heat such as that from the summer sun causes much expansion. The blocks buckle before the pressure can be taken care of by any ordinary expansion joint. Wood blocks laid on a concrete base will give more satisfactory service but are more expensive than concrete alone and will not give as satisfactory results as this latter type of platform surface.

It is not possible to maintain a smooth surface with a brick platform which is not laid on a concrete base, owing to uneven settlement of the brick and the heaving action of frost during the winter months. The surface of the bricks themselves is not so smooth nor so easily kept clean as the concrete or bituminous surface. As with other materials, a bituminous wearing surface which is not laid on a concrete base is subject to uneven settlement but is more easily kept clean than either the brick or wood block.

Platforms made of either of the three materials mentioned do not shed water perfectly because they are subject to settlement and expansion and contraction during warm and cold weather. In my opinion, concrete is the most suitable material for a coach yard platform because a smooth surface can be maintained. It is not subject to uneven settlement and, since it sheds water, it keeps the bed underneath the platform surface dry. The surface of a concrete platform can be kept clean easily, while contraction and expansion can be cared for by expansion joints which are easily designed and easily installed, as has already been implied. If the platforms are constructed of wood blocks, brick or of any of the bituminous compounds, these surfaces should be laid on a concrete base, but in my opinion the concrete when used alone will make a better job and is more economical.

For the reason that a great deal of water is ordinarily used in washing coaches, it is important that coach yards and coach yard platforms be well drained. So far as the platform itself is concerned, this can be provided best by having an impervious material such as concrete for the platform surface. The platform should be even with the top of the rail at the curb and should be crowned sufficiently to provide good drainage, but no more than is necessary for this purpose, since, otherwise, some hazards may be caused in slippery weather. The concrete platforms should be poured monolithically with the curb and gutter. The edge of the curb should be placed at such a distance from the adjacent track that the water will not drip off the car directly onto the platform, but rather into the gutter between the curb and the ends of the ties.

Platforms Should Have Smooth Surfaces

By Engineer of Buildings

Too frequently, consideration of the proper platform construction in coach yards is neglected or the subject is dismissed as of little importance. The result is that on many roads, wood plank platforms are still the rule rather than the exception. In a coach yard, where the location is known to be permanent, the construction of the platforms should be given the consideration which their importance deserves.

After a plank platform, wood block is probably the least satisfactory form of construction for coach yard purposes. No form of preservative treatment has yet been devised which will prevent wood from absorbing moisture. In a coach yard, the water from the coach washing operation added to that from rainstorms, causes the wood blocks to swell and, unless extreme care is used in laying the blocks, the resulting expansion will cause the platform surface to buckle and lift and finally to break in such a manner as to displace many of the blocks. While wood blocks make an excellent floor surface and are highly satisfactory for use on covered platforms, it is difficult to maintain as smooth a surface on a platform laid with wood blocks exposed to the weather as should be provided on a coach yard platform.

While brick has many advantages in passenger platforms and for many other purposes, it is not altogether satisfactory for platforms in coach yards, owing to the fact that the surface cannot be made as smooth as desirable.

A well-laid bituminous platform gives excellent results since it can be made smooth and has the further advantage that it does not absorb water nor become uneven with use. It presents an excellent surface for trucking and is not easily damaged by the dropping or falling of heavy material.

It is assumed that the three materials which have been mentioned will be laid on a concrete base, as otherwise uneven settlement is likely to occur, thus leaving the surface of the platform in an unsatisfactory and perhaps unsafe condition.

Concrete platforms offer equal advantages with bituminous platforms with respect to smoothness, permanence and good drainage, while they can be installed by the regular concrete forces which most roads maintain. If properly treated in use, they require little maintenance.

Coach yard platforms should be maintained at the elevation of the top of rail in the coach yard tracks. If this is done, roadways or lanes can be maintained across the tracks without interfering with

the work of car repairers or other mechanics. The platform and curb should be at the same elevation except for such crown, approximately ¼ inch to the foot, as is necessary for drainage.

Valve boxes for water, steam and air and outlets for electrical connections, when placed in the platform, should be flush with the platform surface and should be provided with self-closing covers.

Avoiding Deposits from Water in Side Ditches

What methods are most practical for preventing washing and deposits on the right of way by water in side ditches?

Keep the Ditches Free from Obstruction

By J. J. Hess
General Roadmaster, Great Northern, Seattle, Washington

Our practice is to keep ditches free from weeds, brush or other obstructions which affect their carrying capacity. Any obstacle to free flow is likely to divert the water from its natural course or, during periods of heavy run-off, to cause it to overflow, in either of which events considerable damage may ensue.

Often the construction of a bulkhead or the placing of riprap will prevent wash, while straightening the channel may cure the troublesome problem of deposits. In some instances underground boxes or large pipe conduits offer the only remedy, particularly in easily eroded soil or ground that is soft and spongy.

In side ditches which are already established, we often resort to sloping the banks and then lay a facing of heavy stone of such thickness as may be required, using great care to carry it to a sufficient depth to avoid danger of undermining. In other cases we have installed brush mats, while in still others we have found it possible to fill in existing ditches and dispose of the water through other channel.

Prevention Is Better Than Cure

By Division Engineer

Prevention is always better than cure, and while it is not always possible to prevent the trouble implied by the question, diversion or interception of the water before it reaches the right of way offers the best solution, if this is practicable. Where this cannot be done, the ditches should be kept as straight as possible and maintained free of obstructions. All brush and weeds should be kept out of the ditch and cleaned away from the sides, although it is sometimes advisable to plant willows along the edge of the bank if erosion is excessive.

In some instances of which the writer knows, the only practicable cure has been to line the ditch with concrete at the point where the washing could not be controlled by other means. In other cases, hand-laid riprap of heavy stone has been sufficient. Another method which is sometimes practicable, is to install pipe of sufficient diameter at the points which give the most trouble and cover it to a depth which will prevent overflow at times of abnormal runoff.

If the ditch carries either surface or subsurface drainage from a long or deep cut, it may wash because of the steep grades which are necessary in order to lead the water to a natural watercourse. In this event a series of dams constructed of creosoted ties or bridge timbers which have been removed from service, not only reduce the amount of wash but they can be constructed at small cost and will last for many years.

As a general rule, differentiating side ditches from larger and more important streams, there is little trouble from either wash or deposits during periods of normal flow. The trouble usually occurs as a result of heavy rainfall or melting snow. For this reason, maintenance officers usually have ample time during the intervals of quiet flow or no flow to take whatever measures may be necessary or practicable. Work of this character should not be neglected, as often there is little that can be done in the way of prevention or correction while the damage is actually occurring.

Pumpers' Daily Reports

What are the advantages, if any, in requiring pumpers to make a daily report of water pumped and supplies used?

Gives Pumper a Sense of Responsibility

By C. H. Koyl
Engineer Water Service, Chicago, Milwaukee, St. Paul & Pacific, Chicago

It is our custom to have pumpers record daily on a monthly sheet, the amount of water pumped and supplies used and to send in the report monthly. The advantage of this practice is the training of the pumper to accurate observation and to a sense of responsibility. At water softening plants it also enables the water engineer to keep track of chemicals and prevent waste.

There is a disadvantage, in that, in ordinary pumping stations, it is easy to waste time and paper on inconsequential details.

Permits the Cost of Operation to Be Checked

By C. R. Knowles
Superintendent Water Service, Illinois Central, Chicago

It is desirable that pumpers or other attendants at pumping and water treating plants keep a daily record of water pumped and supplies used. As a rule, this record forms the basis of a report made to the supervisor water service weekly or monthly.

Comparatively few railway pumping stations are equipped with meters or other measuring devices for determining the amount of water pumped. Therefore, a daily record of the number of hours the pump is run or the number of feet of water pumped into or taken from the tank is necessary in order to determine the amount of water handled. In some cases, the pumpers are required to show the water pumped in gallons, which is determined from the capacity of the tank in feet, if the tank is remote from the pump house, or by the pump capacity per hour at a given speed.

Aside from the advantages of a report of this kind in keeping a record of water pumped and fuel and supplies used, it also permits a careful check to be kept on the cost of operation, as any increase in cost may be detected immediately by an examination of the report.

The amount of fuel and supplies used at pumping stations is, of course, shown by invoices or transfer bills. Costs and quantities shown on these invoices do not permit of an accurate check for a given period, however, and, inasmuch as good engineering and good management require fundamental facts, it is de-

sirable, in the interest of economical operation, that a daily record be kept by the pumper. The preparation of these daily records by the pumper or pumping station attendant has a value beyond that of merely determining the amount and cost of the water pumped, as they require the pumper to know at all times just what results he is obtaining in the operation of his plant. It is obvious that he is primarily responsible for any economies that may be effected in the use of fuel and supplies at pumping station. It is important, therefore, that he know at all times the quantity of water pumped and its relation to the fuel and supplies used.

Enables One to Detect Unusual Conditions

By Foreman of Water Stations

I have required daily reports from pumpers for many years, as I find that they have a definite value in keeping me informed currently of the performance of all water stations under my jurisdiction, while they enable me to detect readily any unusual conditions. Furthermore, they afford a ready reference when considering the improvement or replacement of pumps, engines or other machinery and pipe lines.

During the past ten years, many improvements have been made in connection with the water supply system on this railroad, as a result of which we have made a marked reduction in the cost of the water supplied to locomotives and I have found my style of daily reports an excellent guide in preparing general reports of what has been accomplished.

Reports of this character have another value, because they enable us to compare the performance of various pumpers on the territory, particularly those who are provided with similar equipment. In this way we are able to give particular attention to those whose performance is least satisfactory and educate them to the point where they are making an average or even better performance.

I am unable to conceive how anyone who is responsible for the performance of the water supply department of a railway can carry on his work intelligently or make recommendations based on facts, unless he is using a system of daily reports or some other similar system which will show what has been and is occurring at each individual pumping station.

Planting Trees and Shrubbery

What time of the year is best for setting out trees and shrubbery around section dwellings, in station grounds or elsewhere? What precautions should be observed in doing this?

Can Be Planted Either in Fall or Spring

By C. R. Peterson
Landscape Gardener, Delaware, Lackawanna & Western, Short Hills, N. J.

In general, the best time to set out deciduous trees and shrubbery in the eastern states is during the months of April or October, although we begin to plant about the 15th of March if the weather is not severe, and continue on to June 1. In many instances we also begin setting out plants of this type about September 1, and continue on to November 15, depending on the character of the weather in the later part of the period.

Conifers, evergreens and evergreen shrubs should be planted a little later in the spring or a little earlier in the fall, September being the best month for this purpose. In the western states it is desirable to set out this type of plant still later in the spring or earlier in the fall.

Large trees should be stayed by three lines of guy wire set about 45 deg. and fastened to strong stakes or other anchorage, in order to prevent the wind from loosening the tree or tipping it before the roots have obtained a firm hold upon the soil.

All trees and shrubs, as well as herbaceous plants, including rose bushes, should have the best soil available. Well decayed manure or some dependable type of fertilizer should be worked into the soil and put around the trees after the roots have been covered with fine soil, so that neither the manure nor the fertilizer will come directly into contact with the roots. After the soil and fertilizer have been placed, the roots should be watered thoroughly and the water allowed to soak in well, after which the remainder of the hole should be filled with soil which should be packed down slightly. After this, loose soil should be put on top and not packed in any manner. It is advisable to cut back trees and shrubs when planting, in order to avoid starvation of the plant before the roots are properly established in the soil.

Depends on Soil, Climatic Conditions, Etc.

By H. W. Van Hovenberg
Sanitary Engineer, St. Louis Southwestern, Texarkana, Texas

It is impossible to make a hard and fast rule as to when plants should be put into the ground, since any scheme of landscape gardening will depend directly on the soil, the climatic conditions and the kind of plants to be used.

Shrubs may be divided into three general classes: (1) Conifers, (2) broadleaf evergreens, and (3) deciduous shrubs. The conifers, particularly arbor vitae, and all broad-leaf evergreens belong to the milder climate, and best results are obtained by planting them in the fall. In planting both conifers and broad-leaf evergreens, however, it is advisable to take the shrub with a ball of earth, and by doing this and exercising care in planting, and with sufficient watering, we have successfully planted conifers and broad-leaf evergreens even in mid-summer. Deciduous plants should be planted before they bud out and that depends, of course, upon seasonable conditions. In the Southwest we plant deciduous shrubs and trees from November until the middle of March, while in the northern part of Arkansas, in Missouri and Illinois, planting is done after the frost is out of the ground, usually the latter part of March and through April.

In handling shrubs, care must be taken not to break the ball of dirt from around the root. The balled shrub should be lifted by the ball rather than by the plant itself. In planting, it is not necessary to remove the burlap covering from around the ball. Merely rip it at the top and down the sides in three or four places. In this way the root system is not disturbed.

The preparation of the soil is of the utmost importance in planting trees and shrubbery. If the natural soil is of poor quality, replace it to a depth of at least two feet with good loam. For a single plant, dig a hole twice as large as is necessary to contain the roots. Never crowd the roots. Let them spread out in their natural positions. For group or mass planting, dig out the whole area and fertilize the soil with well rotted barn-yard fertilizer. Drainage

must be considered, and, if natural drainage is poor, provision must be made for artificial drainage. It is of extreme importance when planting in the fall, not to leave holes near the shrubs in which water can collect.

Shrubs should not be set too deep. The hole should be dug a little deeper than the shrub is to be set and, in filling, the dirt should be worked gradually under and around the root by gently lifting the plant up and down, until no cavities remain around the root and the plant is brought to the proper level. When the hole is filled within three or four inches of the top, pour in two or three buckets of water, and when this has disappeared fill the hole, leaving a slight depression around the plant. In planting a balled and burlapped plant, place the plant in a hole so that the top of the ball is not more than one inch below the level of the ground. Put in enough dirt to hold the ball with the burlap, as described, and, if it is tied around the plant, be sure to remove the string. Then fill the hole the same as with a bare-rooted plant. The ground around the new plant should never be allowed to become dry and hard, and if there is not sufficient rainfall, artificial water should be supplied.

Inspecting Timber Trestles

What details should be given particular attention in making an inspection of a timber trestle?

Depends on Material and Location

By D. Rintoul
General Bridge Inspector, Southern Pacific, San Francisco, Cal.

The procedure in making an inspection of timber trestles depends somewhat on the kind of material that is used in the structure and its location.

In making an inspection of untreated timber trestles in wet territories, particular attention should be given to the piles at and a little below the ground surface, and at the bearings of braces, girders and caps. Decay or crushing of the timber in caps is most likely to occur at bearings on piles and at the bearings at the stringers. Stringers decay first in the joints and directly under the ties, while the first decay in the ties usually occurs at the rail bearing.

Particular attention should be given to weathering and mechanical wear as well as to decay when making an inspection of untreated timber trestles in arid territories. In these structures the piles decay at the point where they contact with the earth, but, frequently, the most serious decay occurs at a considerable distance below the surface of the ground. Decay at depths of four or five feet is not uncommon. Because of the extreme dryness of the air, stringers and caps are likely to check badly and break. Ties also often weather and check, frequently so badly as to allow the spikes to loosen.

The first indication of decay in creosoted timber trestles in wet territories usually appears in the pile. In this type of structure, the decay usually starts at the head of the pile, as a result of moisture entering at the point of cut-off and continuing down along the grain through the interior of the stick. This condition is very destructive and demands close attention, particularly after the piles have been in service ten years or more. A close examination of stringers, ties and caps is necessary to detect any decay which may be occurring around holes that have been bored in the field for bolts or other fastenings.

In arid territories, creosoted timber trestles have exceptional life. Ordinarily, during inspection, attention is confined to decay of the timbers at points where they come in contact with the earth and to the crushing or breaking of the timber in caps or stringers.

Inspection Is for Two Purposes

By H. M. Church
General Supervisor of Bridges and Buildings, Chesapeake & Ohio, Richmond, Va.

The inspection of a timber trestle may be divided into two classes: (1) Current inspection to insure safety of operation; (2) inspection for programming work. The particular attention that should be given to details in the examination of the structure, however, is applicable to both classes of inspection.

When making the inspection of the deck of a timber trestle, the ties and timber guard rails should be examined for soundness and it should be observed whether the ties are in condition to hold the spikes firmly. Stringers should be examined very closely for soundness throughout, and particularly at the ends and at all bearing points. Any defects in the track on the structure or its approach should be noted and a record made for handling, to insure that the conditions are corrected by the track forces. In addition to this, the general condition of the line and surface should be noted.

The bents should be examined to determine whether they are plumb and whether all transverse bracing is sound and in place. Diagonal and vertical posts should be checked to see whether they have equal and uniform bearings and are in proper place, sound and not crushed at the ends. If the bent is supported by mud sills, these should be examined to determine whether the blocking is sufficient to prevent settlement and to insure that the fills have a uniform bearing on the blocking.

The feature that should be given special consideration when making the inspection for programming work is the nature of repairs that have been made recently. In the event that any work has been done for the express purpose of strengthening the trestle for heavier loading, ascertain that the proper number of stringers are in place as required for the various span lengths. After the renewal or addition of stringers to the structure has been made, check to see that the ties have full bearing on all stringers when under load. All main members, particularly those which are approaching the end of their service life, should be checked for interior decay.

Inspection Should Be Thorough

By A. B. Scowden
General Bridge Inspector, Baltimore & Ohio, Cincinnati, Ohio

In general, the details which require the closest attention are those which most seriously affect the safety and riding qualities of the structure. The inspector who has learned to watch these with particular care and report defects intelligently, makes a reliable and valuable man. In starting his work, the inspector should examine the track for line and surface over the bridge. Irregularities found here will often give warning as to the location of defective conditions in the structure below.

The inspection of a trestle must be systematic in order to be thorough. The inspector should first do his work from below, starting at one end, examining each bent thoroughly in order and next inspect the top of the deck, likewise working from one end of the structure to the other.

Piles should be examined for decay at and directly below the ground line, and at the top for splitting. They should always be sounded for possible interior decay. Special attention should be directed to soft mud, or pumping, at the ground line.

Mud blocking should be inspected for soundness and surface, and any displacement noted.

Sills should be inspected particularly, to determine whether there is any crushing at the bearings of the vertical and batter posts, while the underside should be given the same attention, to detect any evidence of crushing at the point where they are supported by the piles. They should also be examined to determine whether any longitudinal splitting is occurring.

All vertical and batter posts should be checked for soundness of timber, particular attention being directed to the ends which rest upon the sills. Also, every bent should be examined to make certain that it is standing plumb.

Caps should be investigated for signs of crushing at the bearing points of posts and stringers, and for signs of longitudinal splitting.

While working from below, the inspector should examine the under side of all stringers, particularly where they rest on the caps. While working from the deck, he should examine the tops of the stringers for soundness and give particular attention to the condition of the wood at the ends of each stringer where decay is most likely to start.

The important items to observe in connection with the ties are whether the spacing is regular, and the condition of the timber where it rests on the stringers and under the rail bearing. The condition of the spikes should also be observed.

The most important detail with respect to the secondary members of the structure, aside from the soundness of the timber, is to observe whether the bolts in the transverse and longitudinal braces are kept tight.

Laying Rail

How many assistant foremen should be provided for a rail-laying gang of 150 men, and how should they be assigned?

Every Unit Requires Supervision

By Engineer Maintenance of Way

In laying rail there are certain well-defined operations to be performed, and in any well organized gang these various items of the whole operation will be performed in their proper sequence. In order that this may be done without confusion and each subsidiary part of the work completed in sufficient time to insure that the next one in sequence will not be delayed, ample supervision by experienced assistant foremen is required.

The various steps in work of this character, each of which should be performed by a separately organized gang in charge of an assistant foreman include in the order which they should be done: Distributing material, such as tie plates, bolts, spikes, tie plugs and rail anchors; pulling spikes; throwing out the old rail; adzing, which can be organized to include the removal of the old tie plates, driving down spike stubs; inserting tie plugs; adzing the ties; painting the adzed surface with hot creosote and replacing the tie plates; laying the rail and tacking it into position; placing the angle bars and inserting the bolts; bonding the rail, if in automatic signal territory; tightening the bolts; gaging; full spiking; placing rail anchors; collecting discarded material for shipment; and breaking up the old rail and piling the fastenings to facilitate loading.

While the sequence of some of the items following the rail laying may be varied to some extent, in general, the gang should be organized about on the lines mentioned. It often happens that the gang which is engaged in distributing the material can complete its work in sufficient time to assist in assembling the discarded material for loading during the later hours of the day. Where power adzers are used, this part of the work can be performed with sufficient rapidity so that the adzing gang and the throwing-out gang can be assigned to other work during the afternoon.

Present day methods of rail laying differ widely from those which were followed a few years ago, when the entire operation was performed with hand labor. Under the former condition, gangs ranging from 150 to 200 men in size were not uncommon. During this period it was the usual practice to lay all rail under traffic and this required that the various units be nicely balanced and held reasonably close together in order that quick closure could be made, to avoid delay to trains, but this materially slowed down the work of laying rail.

Under present conditions, on multiple track lines with traffic diverted, a smaller gang which is fully equipped with power machines and tools can be strung out somewhat, so that the men can be used to much greater advantage, with the result that there is less confusion, the work goes along more smoothly with a minimum of idle time and the output per man is proportionately greater, even when making allowance for the advantages of the power equipment.

While many experienced maintenance men may not agree fully that it is necessary to assign an assistant foreman to each of the units mentioned, rail laying, as practiced today, is a high-speed operation which requires the fullest supervision in all of its details, if the best results physically and economically are to be obtained. There are many separate details, each of which requires constant attention by a responsible leader, which the general foreman who has charge of the whole operation cannot oversee individually, so that he must rely on experienced subordinates to take care of these details. For this reason, and from an economic standpoint, the additional amount spent for intelligent supervision is returned many fold in better work and lower costs.

Four or Five Foremen Are Sufficient

By W. E. Connell
Roadmaster, Panhandle & Santa Fe, Pampa, Texas

If rail is to be laid with a proper bearing and the correct allowance for expansion, with spikes squarely driven, to correct gage, with tie plates in the right position and the finished job turned out to conform to the high standard expected in work of this character, there is no detail of the entire operation that can be slighted without detriment to the work as a whole. In work of this character which must be done under considerable pressure, no part of the cost gives greater returns than the money which is spent for supervision. When rail is laid, every precaution should be taken to see that no details are neglected that may impair the results.

It would require too much space to set out in detail the organization of a rail-laying gang composed of 150 men, but less than four assistant foremen can

not be considered adequate for such an organization, under present methods and practices. Five assistant foremen more nearly reach the requirement, particularly if there is much switch work to be encountered and the work is being done on a railway of heavy traffic.

One assistant foreman should be assigned at the front to take charge of spike pulling and material distribution. Another assistant foreman should be placed in charge of the throwing out of the rail, adzing, plugging the spike holes, painting the adzed surfaces with creosote and replacing the tie plates. He should watch particularly to insure that spike stubs are driven down and that the adzing is done properly, since it is important that the ties be properly prepared to receive the rail.

There should be another assistant foreman directly in charge of the rail-laying operation, whether it is being done by hand or by a rail laying machine. He should be charged with the responsibility of seeing that the correct expansion allowance is made, that rail ends are oiled and that the rail is properly seated on the tie plates, with no foreign substance between them which would cause an uneven bearing and distort the gage.

Two assistant foremen should be assigned for duty behind the rail laying proper to look after all incidental items that are often overlooked in rail jobs, such as squaring up plates, seeing that spikes are squarely driven and that the rail is brought to correct gage, that joints are properly bolted and tightened, that a sufficient number of rail anchors are placed to hold the rail and maintain the expansion, to look after tools and see that discarded material is picked up and piled for loading.

It may be possible to dispense with the services of one of these assistant foremen, provided there is no switch work that requires a part of his time and that all material that goes to complete the job is on hand. Taking into consideration the necessary motor car trips for miscellaneous items, however, and the number of other things that ordinarily come up, which require that a responsible person leave the organization, the fifth assistant foreman can be considered as almost a necessity in a properly organized and efficient gang.

Painting with the Spray Gun

What are the advantages, if any, in the use of the spray gun in the painting of steel bridges?

It Is Faster and More Economical

By E. C. Neville
Bridge and Building Master, Canadian National, Toronto, Ontario

My experience has been that there are numerous advantages in the use of the spray gun in painting steel bridges. In the first place, it is more economical from a labor standpoint than the brush method, owing to the fact that from five to six times as much surface can be covered in the same time, depending of course, on the nature of the work or the class of structure that is being painted. On large plain surfaces, such as plate girders, one man with a spray gun will generally cover more surface than six men with brushes. On lighter work or smaller surfaces, however, such as small angles, etc., the difference is not so great, because more care is necessary in operating the gun in order to avoid wasting the paint. Another advantage is the ability to apply the paint more evenly, leaving a plain smooth surface, unscratched or ridged, as is often done when the paint is applied with a brush.

It is often maintained that it is impossible to paint properly around rivet heads with a spray gun and that a much better job can be done with a brush. Whether this is true depends in large measure upon the operator of the gun. A good operator soon learns that by a slight twist of his wrist, which gives the gun somewhat of a rotary motion, he is able to cover thoroughly the area between the rivets and around the rivet heads.

The preparation of the surface by cleaning with a sand-blast or other means is of vital importance in the painting of structural steel and usually costs more than the painting itself. It is not difficult, therefore, to recognize the advantages in the use of the spray gun on jobs where much cleaning is required. By its labor-saving feature the spray gun permits a larger number of the members of the gang to be employed on the cleaning of the steel. In this connection, there is another advantage in the use of the spray gun, since the paint supply can be shut off and the gun used with straight air for blowing loose particles of rust and dust off the surface, instead of this being done by the slower method of using a brush or duster.

Spray Painting Promotes Economy

By General Foreman of Painters

It is the objective of every maintenance officer to reduce labor so far as possible. This does not of necessity mean a reduction in the number of men worked, but it does mean that many forms of mechanical equipment can be used to increase the output per man, so that more work can be accomplished with the same or even less effort by the members of the gang.

The spray painting of steel bridges and other iron and steel structures is one method whereby the cost of the work can be materially reduced and at the same time the amount of effort which is required decreased. By the use of the spray gun, a better and smoother job can be done with the consumption of less paint, if the operators are expert. The spray gun also often permits access to places that cannot be painted properly with a brush.

Since compressed air is required for its operation, only a small amount of additional equipment makes it possible to do the cleaning by means of a sand blast, thus giving the additional advantage of better preparation of the surfaces to be painted. For the same reason, pneumatic chipping and scaling tools can be substituted for the hand tools that are ordinarily used in these operations, after which the cleaning of the surfaces can be completed with the sand blast.

The introduction of the spray method must usually be made over the serious objections of the men who have been accustomed to the use of the brush and who take pride in the character of the work they do. It has been my experience, however, that after they have been educated to the use of the new device and become experts in handling it, few of them are willing to return to the slower and more laborious method of brush painting. They find that less effort is required and that they are able to do a smoother and better job, and at this stage, take as much pride in the work they are accomplishing as they did when wielding the brush.

New And Improved Devices

A New Design of Switch Lock

A NEW TYPE of switch lock, known as the "Eversure" switch lock, designed to replace the time honored padlock, has been developed by the Railway Safety Switch Lock Company, Boston, Mass. The lock consists essentially of a cast-iron housing and the locking mechanism which it encloses. The housing is securely attached, by means of socket screws, to the bifurcated end of a segmental pinion, and is designed to provide room for the vertical angular sweep of the upper end of the operating lever. A detent arm is secured pivotally in the top of the housing so that it swings downward at its free end and rests in a vertical position when the operating lever is in the closed position and the switch key removed from the lock.

A Switch Unlocked and Ready to Throw

To unlock the switch, the key is inserted and turned clockwise. By means of an ingenious but sturdily constructed mechanism, the detent is lifted out of the path of the upper end of the operating lever, which can then be raised to the horizontal position and rotated to open the switch points, which are connected with the switch crank in the usual manner. When the operating lever is lowered in the full-open or full-closed position, the key may be turned in the reverse direction, thus lowering the detent to its former position, and removed, leaving the switch locked. As a safeguard against tampering with the switch by unauthorized persons, an extension member having a hook is provided, so that if an unsuitable key or other instrument should be used the lock is prevented from turning.

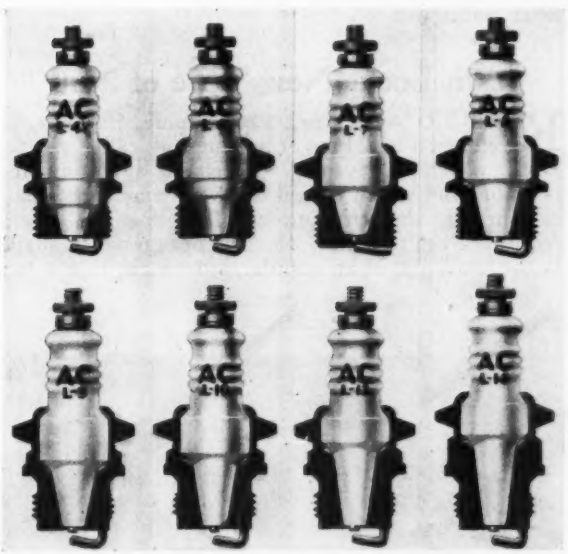
The locks are designed to be opened with a standard switch key so that they may be installed at random, thus eliminating the necessity of a complete installation over an entire district. They may be quickly and cheaply applied to switch stands already in service, including ground throw stands, without altering the standard equipment or interfering with its normal use.

The locking bolt is controlled by positive action of the key, so that it is not dependent on springs or the action of gravity. The key cannot by removed until the switch is locked, thus acting as a reminder to the operator to leave the switch locked in its proper position.

This lock has been used by the Great Northern for about five years; at present this road is using it extensively and is said to have found it safe, economical and satisfactory in other respects.

Spark Plugs for All Conditions

TWELVE new spark plugs in 7/8-in. regular and metric sizes for heavy-duty service were placed on the market recently by the AC Spark Plug Company, Flint, Mich. The plugs are graded according to a new heat range system that has been developed by this company, whereby plugs may be provided to meet



Some of the AC Spark Plugs Graded According to the Heat Range

all conditions of engine and operation. This system consists of a group of spark plugs graded from the hottest to the coldest. That is, spark plugs of different lengths of insulation are provided, depending on whether the engine is operated steadily at an extremely fast speed or at an extremely slow speed. That portion of the insulator of the spark plug that is exposed to the combustion chamber governs the heat range and, according to this system, a spark plug of the proper length of insulation may be chosen to meet the particular conditions.

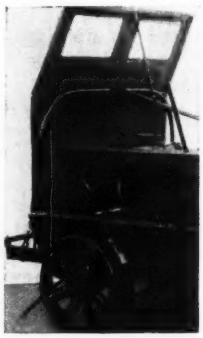
The electrodes of these spark plugs are made of a new alloy which also has been developed by this company and which is said to require 50 per cent less volt-

age to produce a spark then usually required, permits easy starting during cold weather, has a long life and minimizes gap adjusting.

Other features of these spark plugs include a welded side-wire electrode, permitting a high electrical and heat conductivity, one-piece construction and solid copper gaskets.

A New Windshield

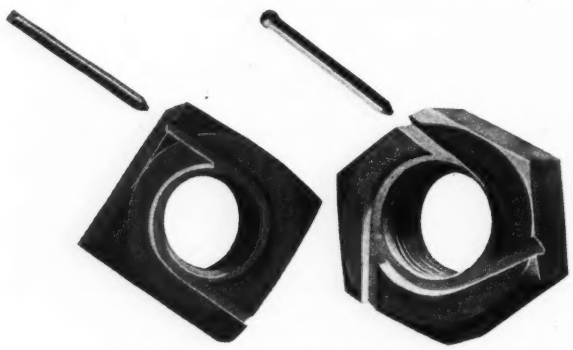
FAIRMONT Railway Motors, Inc., Fairmont, Minn., have developed a new windshield designated as the "Storm King" M11366, which is designed to fit any motor car with a high front cross rail and a center rail or brace. This shield is high enough to afford complete protection from the wind and visibility is provided by two windows of extra heavy celluloid, situated at the proper height. The upper panel is adjustable for both height and slant. Protection is furnished by waterproofed, heavy, brown duck mounted on a substantial metal frame. This equipment weighs 18 lb., is readily demountable and may be hung up flat in the tool house for storage, when not in use.



The "Storm King" in Position

Pin Locks New Type of Nut

KRABERHALL, Inc., Philadelphia, Pa., has developed a new type of locking nut, called a "Pin-Nut," which is designed to lock on a bolt in any position, and which is said to be proving effective on certain frog and crossing installations. The special feature of the new nut, which is hexagonal in shape, is the provision of an annular groove cut in the face of the nut, into which is driven a special locking pin after the nut has been turned up on the bolt the desired amount.



Two Styles of Pin-Nuts

Pin-nuts can be manufactured in all sizes, and to the present time have been made in sizes ranging from ¼ in. to 3 in. They fit any kind of bolt, as they require no special thread, and are used without lock washers, jam nuts, or cotter pins. The pin used with the nut is triangular in shape and fits directly into the thread of the bolt, creating friction on the sides of the thread and the face of the annular groove in the nut. It is said that the threads of the bolt and nut are not damaged in any way by the application of the pin, and that when the pin is removed, the nut can be backed off by hand, and the entire assembly, the bolt, nut and pin, can be used over and over again. No relative position is needed to lock the nut, nor is it necessary that it be tight against any surface.

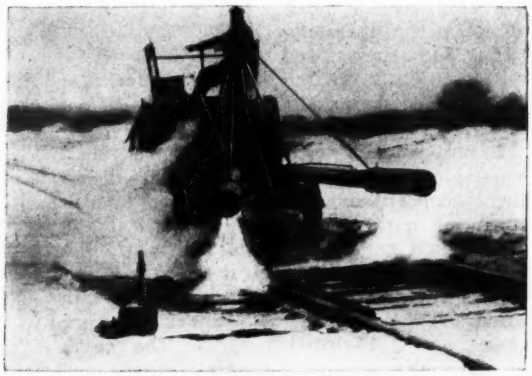
The nut is removed in either of two ways; by tightening the nut, in which case the pin slips out, straightening itself as it emerges from the annular groove, or by applying a wrench and backing off the nut with the pin in it. This latter way requires a great deal of wrench pressure, but it is said that the nut can be removed in this manner without causing damage to the thread of either the bolt or the nut or to the pin.

Ordinarily the pin used with the nut is without a head and, therefore, when the pin is driven into the nut there is no projection beyond the sides of the nut. The illustration shows a pin with a head, but this type of pin is used only where there is no objection to the protruding head.

Weed Burner Also Melts Snow

THE Woolery Machine Company, Minneapolis, Minn., has converted its Midget "Octopus" weed burner into a machine of year-round utility by adapting it to the melting of snow and ice. The Midget is the smallest of the "Octopus" line of weed burners, being a two-burner machine which was built primarily for small railways and for work around yards and terminals.

By the utilization of specially designed burner heads, this machine has now been converted into a combination equipment adapted for the burning of weeds in the summer and for melting snow and ice in the winter. It is of particular advantage in eliminating snow and ice from switches and frogs, interlockings and similar locations, particularly on ladder tracks in large yards.



The "Octopus" in Snow Melting Service

As described in the March issue of *Railway Engineering and Maintenance*, the Midget "Octopus" is operated by one attendant and a helper, while each burner is under separate and positive control. With both burners in operation, the machine will clear snow and ice from a strip 10 ft. wide, while the long arms can be set to throw flames to a width of 18 ft., or, with special burner heads, to a width of 25-30 ft. The burners operate with equal facility and efficiency on kerosene, distillate or light fuel oil.

What Our Readers Think

The Cause of Creeping Rails

Tucson, Ariz.

TO THE EDITOR:

Many theories have been advanced as to the cause of creeping rails, some ridiculous, and others having some merit. After watching this phenomenon for years and ascertaining that the normal movements of the two lines of rails on a single track are in opposite directions, the writer has reached the conclusion that the engine itself is responsible for this movement.

It is well known that the driving pins on the right, or engineer's side, of steam locomotives are advanced one-quarter beyond the position of the driving pins on the opposite side. This lead could be on either the right or the left side, but practice has made it uniform on the right side. When an engine is moving, this arrangement of pins and counterbalances causes a heavier impact on the engineer's side than on the opposite side, and has a tendency to thrust the rail in a backward direction on that side. While this movement may be slight for the passage of a single locomotive, the accumulated movement from numerous trains may be very large. The driving wheels on the left side are always trailing. The movement of the left rail is, therefore, affected only slightly. When a train moves in the opposite direction on the same track, the movement of the left rail, which is now on the right side of the engine, is in the direction opposite to the movement set up in the right rail by the first train. We thus have the two rails on a single track railroad moving in opposite directions, causing the ties to slew and the gage to become tight. The joint ties are also moved out of place, causing pumping joints, if maintenance is not looked after carefully, and increasing the rail batter at the joint. This is one of the most serious conditions to contend with on a railroad.

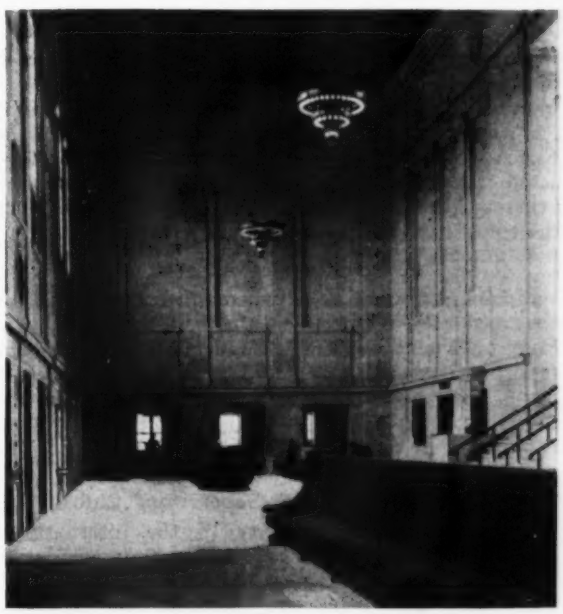
In isolated cases both rails move in one direction, but this can be explained by the fact that brake applications on descending grades have a tendency to move both rails uniformly in the same direction. It will be found on multiple track railroads, on which the traffic moves on each track in one direction only, that the rail on the right side of the engine moves backwards against the current of traffic, and that the rail on the left side has a slight tendency to move in the direction of traffic. The movement of the left rail can be explained by the preponderance of traffic in one direction. Other local conditions may affect the movement of the rails, but these variations can be explained by analyzing the traffic conditions. The normal tendency is for the two rails to move in opposite directions, regardless of grades, curves and other conditions.

Recently, the rail on a highly maintained railroad in the west was damaged by an engine moving at excessive speed. The points of damage were spaced uniformly, and were quite noticeable. There was no doubt that the damage was caused by an excessive blow downward on the top of the rail head, and a simultaneous thrust inward towards the center of the track. The distance between the points of damage indicated that it was caused by a driving wheel of a certain diameter. Since only one engine with driving wheels of this size had passed over the railroad within two weeks, it was easy to detect the engine which was responsible. All of the marks were on the north rail, the engineer's side of the locomotive when the movement was in a westerly direction. This engine was then run on a trial trip to ascertain at what speeds the damage had occurred. This test resulted in a certain amount of additional damage, which again occurred on the engineer's side. This incident is mentioned to show that there is a definite hammer and thrusting action from rapidly moving locomotive driving wheels.

Steam locomotives must be of either right or left-lead type, otherwise dead centers will occur. Until some change in the construction of engines is made, therefore, it is evident that creeping rail will continue as in the past. It is said that the arrangement of driving wheels on electric locomotives is not reciprocating, and thus when they are used exclusively, the rate of movement of each rail is uniform.

In former years, when rails were of 50-lb. to 60-lb. sections and even lighter, the wave motion under passing trains probably had considerable effect on the creeping of rails. With the present heavy rail sections, the rigidity of these sections has overcome to some extent the creeping which results from this wave action. It appears that the only practical method by which creeping rail can be overcome effectively, however, is by the application of a sufficient number of rail anchors. Anchors should be applied throughout the length of the rail, not less than eight to the rail length, to obtain the best results. Of course, local conditions should govern, but for normal rail movement, if the anchors are applied to hold against movements in opposite directions for the opposite rails, their effect will be quite evident. On newly laid track, the movement may not be uniform at first, until the roadbed becomes settled, but after a sufficient tonnage has passed over the track, and proper maintenance has been applied, the normal creeping of rails in opposite directions will be apparent.

P. T. ROBINSON,
Division Engineer, Southern Pacific.



In the New Reading Station at Philadelphia

WITH THE ASSOCIATIONS

American Railway Engineering Association

On April 12 the A.R.E.A., together with the American Railway Association, will move from their present quarters in the Manhattan building, 431 South Dearborn street, Chicago, to the Buckingham building, 59 East Van Buren street. The A.R.E.A. and the A.R.A. will occupy joint quarters, on the twenty-second and twenty-third floors of this building, which is a new structure just opened for occupancy.

A new bulletin covering the assignment of work and personnel of committees, embodying changes made following the close of the convention last month, will be issued early in April. In addition to minor revisions of assignments and personnel, this new bulletin will present for the first time the assignment and personnel of the new Special Committee on Maintenance of Way Work Equipment. It also provides for the change in the status of the Special Committee on Rivers and Harbors to that of a regular committee, which has been assigned the number XXV.

Wood-Preservers' Association

The Executive committee met at the Palmer House, Chicago, on March 12 with six members of the committee present. Plans for the summer meeting were discussed at length with representatives of the A.R.E.A. committee on Wood Preservation, the conclusion being reached that this meeting should be held at Madison, Wis., on June 10-11. An effort will be made to so arrange the program for the meetings of the various committees and subcommittees as to avoid conflict between these meetings and at the same time leave some time for a visit on the second day to the Forest Products Laboratory. It is planned that the members of the two associations will join in a dinner on the evening of the first day.

The Bridge and Building Association

Forty-eight officers and members of the association met at luncheon in Chicago on Wednesday, March 12, during the convention of the American Railway Engineering Association. At that time the Executive committee met and, among other business, acted favorably on 15 applications for membership, bringing the total number of members elected since the convention last October to 24.

The Roadmasters' Association

Members of the Executive committee met with the chairmen of committees at the Hotel Stevens, Chicago, on Tuesday evening, March 11, to review the reports of the committees and to transact other business. The reports that were presented there showed that the work of the technical committees is in advance of that normally existing at this time of the year.

International Track Supervisors' Club

At a meeting on February 13, the International Track Supervisors' Club rejected a recommendation to disband and to become a part of the Central Railway Club, and a plan to continue the club was enthusiastically endorsed. Regular dates for meeting were set for the second Thursday in February, May, August and November, and the meetings will be held, as in the past, at noon, at the Hotel Statler, Buffalo, N. Y.

Twenty-seven members and guests were present at the February meeting, at which the following officers were elected: President, E. J. Cullen, division engineer, Lehigh Valley, Buffalo, N. Y.; vice-president, P. Quinlivan, roadmaster, Delaware, Lackawanna & Western, Buffalo, N. Y.; secretary-treasurer, Charles G. Ericson, Canadian Machinery Corporation, Toronto, Ont.

The next regular meeting will be held on Thursday, May 8, at the Hotel Statler, at 12:30 p.m. Eastern Standard time.

Metropolitan Track Supervisors' Club

The next meeting of the Metropolitan Track Supervisors' Club will be held on Thursday, April 10, at the regular place, Keen's Chop House, 72 West Thirty-sixth street, New York, and will follow dinner served at 6:30 p. m.

The main subject for discussion will be "The Selection of and Qualifications for Section Foremen." A special feature of the meeting will be a talk on "The Importance of Planning Work," by Samuel Baker, Director of the Schools of Civil, Structural and Concrete Engineering of the International Correspondence Schools, Scranton, Pa.

Maintenance of Way Club

A paper dealing with the devices and methods employed by the Chicago Union Station in fighting the severe blizzard of last December was scheduled for presentation before the club on Wednesday evening, March 26, but owing to the unusually severe snow storm which prevailed on Tuesday and Wednesday of that week, the meeting was postponed.

The Tie Producers' Association

The National Association of Railroad Tie Producers will hold its twelfth annual convention at the Hotel Peabody, Memphis, Tenn., on April 29-May 1. The program, so far as now arranged, includes addresses as follows:

Thomas H. Wagner, Jr., southern manager, T. J. Moss Tie Co., Shreveport, La., on "The Separation of Crossties by Grades and Groups."

J. R. Keig, manager, Kirby Lumber Company, Beaumont, Tex., on "The Protection of Crossties from the Time of Cutting and Making Until the Time of Treatment."

C. C. Warne, first assistant purchasing agent, New York Central, New York, on "The Future of the Wood Crosstie."

N. W. McGough, treating engineer, Texas & Pacific, Texarkana, Ark., on "The Seasoning and Treating of Water Oak Timber Cut from Swamp Land."

C. W. Greene, timber treating engineer, New York Central, Toledo, Ohio, on "The Proper Use of Anti-Splitting Devices."

F. C. Sheehan, office assistant to purchasing agent, New York, New Haven & Hartford, New Haven, Conn., on "Line Production in New England."

G. H. Lentz, silviculturist, Forest Service, New Orleans, La., on "Some Growth Possibilities in the Hardwoods of the Lower Mississippi Valley."

C. C. Cook, president, American Wood-Preservers' Association, maintenance engineer, Baltimore & Ohio, Baltimore, Md.

In addition, reports will be presented by the Committee on Statistical Information, of which E. E. Pershall, president, T. J. Moss Tie Company, St. Louis, Mo., is chairman, and by the regional vice-presidents. The annual banquet will be held on Wednesday evening, April 30, with addresses by C. E. Johnston, president, Kansas City Southern, Kansas City, Mo., and M. E. Towner, general purchasing agent, Western Maryland, Baltimore, Md.

RAILWAY NEWS BRIEFLY TOLD

Hugh McCall Tate, a lawyer of Knoxville, Tenn., became a member of the Interstate Commerce Commission on February 20, when the Senate confirmed his nomination which, as noted in the March issue, was made by President Hoover on February 8. Mr. Tate succeeds R. V. Taylor, whose term expired at the end of the year.

The third national conference on street and highway safety is to convene in Washington, D. C., during the last week in May and Robert P. Lamont, secretary of commerce, is inviting the public officers and others interested to be present. Committees will report, among other subjects, on the separation of grades at railway crossings as well as at highway intersections.

Employees' clubs of the St. Louis-San Francisco, whose activities include the solicitation of traffic, secured a total of 9,189 carlot shipments, 9,269 l. c. l. shipments and 7,905 passengers during 1929. This is an increase in carload business secured over 1928 of 42.73 per cent, an increase of 1. c. l. business of 6.81 per cent and an increase in passengers secured of 41.77 per cent.

The Missouri Pacific and the Louisiana & Arkansas have arranged a trackage agreement, subject to the approval of the Interstate Commerce Commission, whereby the Missouri Pacific acquires the right to use the L. & A. tracks into New Orleans, La., and is given on option to purchase that part of the line between Baton Rouge and New Orleans in case the road should be sold to another system.

By extending the length of its locomotive runs, the Great Northern has been enabled to close 14 terminals and to reduce the work at many others, as well as to reduce the total cost of operation per locomotive mile an average of 10 per cent. The average length of the 36 passenger runs that have been extended is 287 miles. Formerly, 72 engines were necessary to protect these runs and their average mileage per run was 144. The average length of the present freight locomotive runs is 227 miles, which is an increase of more than 100 per cent.

Sir Henry Thornton, chairman and president of the Canadian National, announced on February 20 that an option has been given for the purchase of the properties of the Southern New England, which is a projected line between Palmer, Mass., and Providence, R. I., upon which the Grand Trunk (now part of the Canadian National) discontinued work several years ago. The Southern New England is now in receivership and is being liquidated for all the creditors. Sentiment has recently developed in Rhode Island and Massachusetts favoring the completion of the line and a movement is now before the Massachusetts legislature to extend its charter.

The Pennsylvania, in co-operation with the Greyhound Corporation, a motor coach line holding company, in which the Pennsylvania also has a substantial interest, plans to open on April 1 a combination rail and motor coach service between New York, Chicago and St. Louis, and between Philadelphia, Chicago and St. Louis. This new travel co-ordination will permit passengers to utilize motor coaches during the daytime and railway sleeping accommodations for night journeys. Through tickets, which will be sold by both Pennsylvania and Greyhound agents, will contain separate coupons covering the motor coach portions of the journey, the rail trip and the Pullman accommodations.

As the beginning of an active campaign for the recapture of excess earnings and with the intention of complying with the decision of the Supreme Court last May in the O'Fallon case, the Interstate Commerce Commission has selected another nine-mile road, the Brimstone Railroad & Canal Company to receive first consideration. The total income of this road in excess of six per cent for the years 1920 to 1925 (losses were reported for the years 1926 to 1928), was reported to be $520,871, of which one-half, or $260,435, is payable to the commission. On the basis of its own figures, the Brimstone has already paid $42,642 and the order in the present report directs the payment of the balance of $217,793.

The longest double-track tunnel in the world, 11.3 miles in length, which is situated in Italy on the new short line between Bologna and Florence, was dedicated recently by the removal of the last rock separating the north and south headings. Work was commenced on the tunnel in 1913, but was discontinued during the war and resumed in 1920. Since that time, an average of 1,300 laborers have been constantly employed in the tunnel, with 550 additional workmen engaged in outside shops. In length, the new tunnel is exceeded only by the Simplon bore between Italy and Switzerland, which is longer by a few hundred yards. However, the Simplon tunnel has only one track, while the recently completed tunnel has two tracks.

The New York, Pittsburgh & Chicago, on March 3, filed with the Interstate Commerce Commission a brief in connection with the application of that company to construct a line across the state of Pennsylvania. The proposed line would extend between Allegheny City and Easton, a distance of 283 miles, with two branch lines, bringing the total line mileage to 344. The brief states that the new line would shorten the distance between New York and Chicago from 899 miles, which is the shortest route now existing, to 824 miles, and that the eastbound ruling grade would be 0.3 per cent and the westbound ruling grade 0.4 per cent. It further states that the maximum curvature would be 4 degrees and that for every 2.6 miles of line there will be a grade-separation structure. The total estimated cost of the project is $177,740,373 or $628,058 per mile, of which $138,627,853 or $489,851 per mile is the estimated cost of road. A brief in opposition to the application was filed on behalf of the Baltimore & Ohio, the Delaware, Lackawanna & Western, the Lehigh Valley, the New York Central, the Pennsylvania and the Reading.

Great Northern-Northern Pacific Merger Decision

The Interstate Commerce Commission has tentatively approved the unification of the Great Northern, the Northern Pacific and the Spokane, Portland & Seattle, under the name of the Great Northern Pacific, as being in the public interest, but has imposed certain conditions which must be fulfilled before it will permit the consolidation to take place. These include relinquishing control of the Chicago, Burlington & Quincy; the presentation to the commission of a bona-fide and feasible plan for the acquisition of the short lines included in the general consolidation plan; the unified operation of the terminals of the constituent companies; and assurance of the use, upon fair terms, of the S. P. & S. by the Chicago, Milwaukee, St. Paul & Pacific. The consolidation is to be accomplished by means of a 99-year lease from the three companies to the new Great Northern Pacific and by an exchange of the stock of that company.

Construction News

The Canadian National will spend $9,000,000 on branch line construction in western Canada this year, according to a statement by A. E. Warren, western vice-president. The work to be undertaken includes the grading of 261 miles of lines, laying of track on 201 miles and the ballasting of 280 miles. Two bridges of considerable size will also be constructed this year. One of these, over the Beaver river in Saskatchewan, will be 1,300 ft. long and 110 ft. high, with a clear span of 180 ft. The second over the Fraser river, will be 4,100 ft. long and will contain a swing span of 280 ft.

The Montreal Stock Yards Company, a subsidiary of the C. N. R., has awarded a contract to Walter G. Hunt, Ltd., Montreal, Que., for the construction of a two-story brick, concrete and steel office building, 127 ft. by 42 ft., at the Point St. Charles stock yards, Montreal. The Canadian National has also received bids for the construction of a four-story brick addition to a warehouse at the East yard, Winnipeg, Man.

The Chicago & North Western has undertaken preliminary work, including the clearing, and grading and the installation of a drainage system in the area between Western avenue and Lincoln, Fourteenth and Sixteenth streets, Chicago, preparatory to the construction of a potato-handling freight yard which will require an ultimate expenditure of $2,000,000. It was planned to place the first unit of the yard, which can be made available to any railroad in the Chicago area, in operation on April 1. When the complete development has been finished, team track facilities will be provided for 650 cars. This company has been authorized by the Interstate Commerce Commission to construct a 5.6-mile extension to its Gogebic line in Michigan, at an estimated cost of $164,215.

The Chicago, Milwaukee, St. Paul & Pacific has approved a budget of $15,000,000 to be expended for improvements to physical property during 1930. The following major improvements expenditures are included in the budget: Grade separation, changes in Muskego yard and completion of the new car repair shop at Milwaukee, Wis., $1,588,000; track elevation and South Boulevard improvements at Evanston, Ill., and construction of a new commissary and laundry building at Chicago, $1,365,780; new enginehouse and engine terminal facilities at Sioux Falls, S. D., $126,300; new dock and warehouse facilities at Green Bay, Wis., $250,000, and a new depressed track near Government bridge over the Mississippi river at Davenport, Iowa, $145,500. Other general items of expenditure include improvements of bridges, trestles and culverts, $1,610,000; improvements to shops and enginehouses, $785,700; additional yard and passing tracks, $610,000; grade crossing eliminations, $529,000; fuel and water stations, $439,000; station facilities, $557,000. Appropriations of $1,694,000 have also been made for the construction of a new double-track line, to be built jointly with the Chicago, Rock Island & Pacific, from Polo, Mo., to Birmingham, approximately 39 miles, and of $102,500 for main line relocation at Sioux City, Iowa.

The Chicago, Rock Island & Pacific has awarded a contract to John Marsh, Inc., Chicago, for the construction of Section 5, 12 miles, of the joint line with the Chicago, Milwaukee, St. Paul & Pacific into Kansas City, Mo., between Polo, Mo., and Birmingham. This company has also awarded a contract to Petersen, Shirley & Gunther, Omaha, Neb., for the grading of a single-track line between Dalhart, Tex., and Morse, about 65 miles. This road plans the expenditure of $250,000 at its new East Des Moines (Iowa) terminal during 1930.

The Chesapeake & Ohio has authorized a number of projects at various points on its lines, including the extension of double track at Iron Gate, Va.; the construction of a 358,000-gal. steel water tank and water-treating plant at Hinton, W. Va., at an estimated cost of $40,000; and the construction of the west leg of a wye track at White Oak Jct., W. Va., at an approximate cost of $81,000.

The Kansas City Southern has filed an application with the Public Service Commission of Missouri for permission to construct a new double-track freight line, about a mile long, along the Missouri river at Kansas City, Mo., at a cost of approximately $1,500,000. The construction involves the driving of a tunnel 350 ft. long between Delaware and Wyandotte streets on the double-track line which will extend between a point near First street and Grand avenue and the Kansas City Southern's Henning Street freight yard in the central industrial district. Grade separation structures will be constructed at Main street and at Broadway.

The Kentucky & Indiana Terminal and the City of Louisville, Ky., have reached a tentative agreement for the elevation of the railroad's tracks on Thirty-first street between Michigan drive and a point south of Broadway in Louisville by the construction of an earth fill.

The National Railways of Mexico are again contemplating the construction of a railroad about 450 miles long which will link the Tehuantepec National, extending between Puerto Mexico, Ver. C., and Salina Cruz, Oax., with the United Railways of Yucatan and will pass through the states of Vera Cruz, Tabasco and Campeche.

The Northern Pacific has received bids for the construction of the joint line of this company and the Union Pacific in the Olympic peninsula from Moclips, Wash., north to the Hoh river, 60 miles.

The Pennsylvania has awarded a contract to the T. J. Foley Construction Company, Pittsburgh, Pa., for the enlargement of the receiving yard at Bay Jct., Sandusky, Ohio, at a total cost of about $274,000. This contract covers grading, track laying and bridge work for eight additional tracks, which will increase the number of tracks in the yard from 111 to 119, while the capacity of the yard will be increased from 5,517 to 6,277 cars. The capacity of the receiving portion of the yard will be increased from 714 to 1,474 cars.

A contract has also been awarded by this company to J. Rich Steers, Inc., New York, for the removal of old piers in connection with the construction of new piers E and F at Jersey City, N. J., at an approximate cost of $315,000.

The Sprucemont Nevada has been authorized by the Interstate Commerce Commission to construct a line between Ventosa, Nev., and Sprucemont, 23.5 miles, to serve a mining district at an estimated cost, exclusive of equipment, of $375,390.

The St. Louis Southwestern has awarded a contract to the Kansas City Bridge Company, Kansas City, Mo., for the replacement of the draw span over the Ouachita river, near Camden, Ark., at a cost of about $100,000.

The Temiskaming & Northern Ontario has let a contract to H. F. McLean, Ltd., Toronto, Ont., for the construction of an extension of the present line from its terminus at Mile 97, north of Cochrane, Ont., to Moose River crossing at Blacksmith Rapids, about 30 miles.

The Texas City Terminal contemplates the construction of an addition to its grain elevator at Texas City, Tex.

Construction Gets an Early Start

During March, more than 209 miles of new lines in the United States were placed under contract or authorized by the Interstate Commerce Commission, while 30 miles were placed under contract in Canada. In addition, the Canadian National has announced that it will spend $9,000,000 during the year on branch line construction, and a project to build a line 450 miles long at a cost of $16,000,000 is being revived in Mexico.

While there were no projects of unusual magnitude authorized during the month, the total amount of work authorized or placed under contract involves expenditures in excess of $26,000,000 and includes numerous bridges, stations, freight houses, grain elevators, water stations, engine houses, yards, piers, track elevations, grade crossing eliminations and other structures.

Supply Trade News

General

The Track Specialties Company, New York, moved its offices from 29 Broadway to the General Motors Building, 1775 Broadway, on April 1.

The Wolfe Tamper Company, Richmond, Ind., has appointed the **Hopkins Company,** Chicago, as its representative in the middle west.

Personal

George J. Lynch has been appointed district manager in charge of the newly opened branch office of the **Chicago Pneumatic Tool Company** at Tulsa, Okla., with offices at 327 Philcade building.

Sidney B. Grant has been appointed sales representative of the **Buda Company,** New York, in the eastern territory covering the states of New York, New Jersey and Delaware, with headquarters at 30 Church street, New York.

G. A. W. Bell, Jr., maintenance inspector on the staff of the chief engineer of maintenance of the Baltimore & Ohio, has resigned to enter the sales department of the **Northwest Engineering Company,** with headquarters at Washington, D. C.

Albert E. Ferguson, general sales manager of the **National Lumber & Creosoting Company,** has been elected vice-president and a member of the board of directors. Mr. Ferguson will continue to have headquarters at the general offices of the company at Texarkana, Ark.-Tex., and at St. Louis, Mo.

Leonard W. Saine, who has been the representative of the **Central Foundry Company** in the South for a number of years, has been appointed general manager of sales for the Universal Pipe Division of that company, with headquarters in the Graybar Building, New York City. Mr. Saine succeeds **Robert W. Conrow.**

J. E. McCaulley, sales engineer in the Eastern district of the **Union Switch & Signal Company,** with headquarters at New York, has been appointed resident manager of the Pacific Coast district with headquarters in the Matson building, San Francisco, Cal. Mr. McCaulley succeeds **S. E. Gillespie,** who has been elected vice-president of the **Westinghouse International Brake & Signal Company.**

O. D. H. Rohwer, division sales manager of the **Universal Atlas Cement Company,** Chicago, has been promoted to assistant general sales manager, as a result of the merging of the **Universal Portland Cement Company,** New York, and the **Atlas Portland Cement Company,** Chicago, into the **Universal Atlas Cement Company,** Chicago, as announced in the March issue. Several other changes have occurred in the sales staffs of the companies. **N. A. Kelly,** sales manager for the Universal Company, with headquarters at New York, has been appointed to a similar position with the Universal Atlas Company, with the same headquarters. **A. O. Stark,** representative of the Atlas Company, has been appointed assistant sales manager of the Universal Atlas Company, with headquarters at New York. **William A. McIntyre,** of the Atlas Company, has been appointed to direct the sales force working out of Philadelphia, Pa., for the Universal Atlas Company.

Leonard Perez, whose appointment as district sales manager of the **National Lumber & Creosoting Company,** in charge of sales in the St. Louis (Mo.) territory was noted in the March issue, has had considerable railway experience with several roads. He was engaged in various capacities with the Southern Pacific at New Orleans, La., and with the Pennsylvania at Pittsburgh, Pa. At the time of his recent appointment, he was assistant tie and timber agent of the Missouri Pacific.

Leonard Perez

Oliver B. Barrows, representative of the **American Steel & Wire Company,** with headquarters at St. Louis, Mo., died in that city on February 25, following a heart attack.

James D. Cowan, secretary and treasurer of the **National Lock Washer Company,** Newark, N. J., died on February 26 at his home in Summit, N. J., at the age of 42 years.

Trade Publications

Toncan Iron Pipe.—The Republic Iron & Steel Company, Youngstown, Ohio, has issued a 32-page booklet featuring Toncan iron pipe for various classes of service.

Railway Paint Shop and Maintenance Painting Equipment.—The DeVilbiss Company, Toledo, Ohio, has issued a 31-page, well illustrated catalogue bearing the above title, containing data on the design, operation, use and prices of DeVilbiss spray-painting equipment for use by railways. Particular attention is given to this company's self-alining spray head which is designed to give the maximum uniformity of application possible.

Sinker Drills.—The Chicago Pneumatic Tool Company, New York, is distributing the fifth edition of its bulletin No. 850 describing its sinker drills. This 20-page booklet describes the equipment, its construction and its manner of use in detail. The book is liberally illustrated with photographs of this type of equipment in various applications.

Design Standards for Oxwelded Steel and Wrought Iron Piping.—The Linde Air Products Company, New York, has published a 67-page booklet bearing this title, which is the first of a series designed to furnish handbook information on the fundamental designs used in oxwelding steel pipe, which also apply to wrought iron pipe. This information includes data on line welds, welded flanges, fittings and headers, and pipe bends, as well as tables of weights, dimensions and other data on pipe.

Crawler Equipment.—The Northwest Engineering Company, Chicago, has published a 100-page catalogue listing and describing its various types of crawler equipment, their design, specifications and use. This catalogue is divided into eight parts, the first five of which are given over to the description and use of the various types of crawler equipment, one section covers design and mechanical specifications and still another describes the research laboratory maintained by this company and also the various power plants in use in their equipment.

Pneumatic Tie Tampers and Track Tools.—The Ingersoll-Rand Company, New York, has just published a 46-page booklet describing and illustrating its tie tamper units and auxiliary equipment, including spike drivers, spike pullers, track wrenches, bonding and rail drills, wood boring and sawing machines, air hammers, grinders, etc. The equipment and methods of use, including gang organization, are presented in detail as are the auxiliary uses of the tie tamper and its accessories. The book is copiously illustrated and unusually informative.

Portable Electric Tools.—Hicycle portable electric tools, manufactured by the Chicago Pneumatic Tool Company, are described in Catalog No. 897, a 64-page pamphlet, issued by that company. The various sections into which the catalog is divided include drills and reamers; screw drivers, nut runners, stud setters and tappers; and grinders, buffers and sanders. The tools manufactured under this trade name are operated on current having a frequency of 180 cycles which permits a material reduction in the weight of the tools, since it is possible to attain a rotor speed of 10,800 r.p.m.

Personal Mention

General

Thomas Scott, assistant superintendent of the Dallas division of the Texas and Louisiana lines of the Southern Pacific, with headquarters at Ennis, Tex., and formerly general roadmaster on that road, has been promoted to superintendent of the Victoria division, with headquarters at Victoria, Tex.

C. K. Scott, whose promotion to trainmaster on the Erie, with headquarters at Dunmore, Pa., was noted in the February issue, was graduated from Rensselaer Polytechnic Institute, Troy, N. Y., in 1913, with a degree of civil engineer. In July of the same year he entered railway service with the Erie as a transitman in the maintenance of way department at Huntington, Ind., and in June, 1914, was appointed assistant on engineering work in the office of the general manager at Cleveland, Ohio. In December, 1915, he was appointed section foreman in the Huntington yard, with headquarters at Huntington, and in December, 1916, he was promoted to track supervisor at North Judson, Ind. In May, 1918, he was promoted to assistant division engineer on the Meadville division, with headquarters at Meadville, Pa., and in June, 1921, he was promoted to division engineer of the Kent division, with headquarters at Marion, Ohio. In September, 1928, he was transferred to the Mahoning division, with headquarters at Youngstown, Ohio, where he was located at the time of his recent promotion to trainmaster.

Javier Sanchez Mejorda, Minister of Communications of the Republic of Mexico, a member of the board of directors of the National Railways of Mexico, and an engineer by training and experience, has been appointed executive president of those railways, with headquarters at Mexico City. Mr. Sanchez Mejorda was born at Pachuca, State of Hidalgo, in 1886, and obtained his high school education at the Scientific Literary Institute of Hidalgo and his college training in civil engineering at the Engineering College of Mexico City. After graduation from college, his first engineering experience was obtained with the Real Del Monte Mining Company on the construction of ore mills at Guerrero, State of San Luis Potosi. Later he served for a few years as assistant engineering superintendent of that company on the construction of a railway linking Escobar Cabrera and Guerrero and on the construction of the El Rev water works in Coahuila. He was then appointed chief engineer of the River Mazas Waters Commission at Torreon, State of Coahuila, and while in that district he supervised the construction of the electric tramways between Lerdo and Torreon and several irrigation works. Afterward he served successively on government projects as technical advisor on railroads for the Department of Communications, head of the Irrigation Development Bureau of the Agricultural Development Department, engineer in charge of the locating of the railway between San Carlos and Reunion in Hidalgo, an aide in the construction of the Tepexic power plant at Necaxa, Puebla, chief of the first irrigation zone in Lower California, a member of the International Waters Commission and a member of the National Irrigation Commission. This latter appointment was followed by his selection as Minister of Communications, a position he held until his further appointment as executive president of the National Railways of Mexico.

Philemon S. Lewis, superintendent of the Atlantic City (a subsidiary of the Reading) and formerly connected with the engineering and maintenance of way departments of the Reading, has been appointed superintendent of the New York division of the Reading, with headquarters at Philadelphia, Pa. Mr. Lewis was born on May 10, 1889,

Philemon S. Lewis

at Springfield, Ill., and graduated from Princeton University in 1911. In July of that year he commenced his railway career with the Philadelphia & Reading (now the Reading) and has been in the continuous service of this company since that time, except during the period of the World war. During 1911, he held the positions of rodman at Williamsport, Pa., and construction inspector at St. Clair, Pa. From August 12, 1912, to September 15, 1914, he served as assistant supervisor at Harrisburg and Pottstown, Pa., and on the latter date he was appointed signal inspector at Philadelphia, Pa. From 1915 to 1917, he served as supervisor at Camden, N. J., and Olney, Pa., and as trainmaster at Reading, Pa. On September 12, 1917, he entered the service of the U. S. Army and was commissioned successively first lieutenant of engineers, captain of engineers, and major. He also held the positions of executive officer to chief engineer, First Army; executive officer, deputy director general of transportation, and chief of the troops movement bureau, Paris. After he was discharged from the army, he returned to the Reading as trainmaster at Philadelphia, Pa. In April, 1920, he was appointed assistant superintendent of the Atlantic City, and on August 1, 1921, he was promoted to superintendent, in which capacity he served until his recent appointment.

Engineering

A. Lee Atwell, assistant engineer on the Chicago & Western Indiana, has been promoted to valuation engineer, with headquarters as before at Chicago.

E. H. Dresser, chief engineer of the Duluth, Missabe & Northern, with headquarters at Duluth, Minn., has had his jurisdiction extended to include the Duluth & Iron Range, which has recently been leased to the D. M. &. N.

T. W. Fatherson, superintendent of the Western division of the Chicago Great Western, with headquarters at Clarion, Iowa, has been appointed engineer maintenance of way of that road, with headquarters at Oelwein, Iowa.

F. J. Hoffman, division engineer of the Western division of the Chicago Great Western, with headquarters at Clarion, Iowa, has been appointed assistant division engineer of the newly created Minnesota division at St. Paul, Minn.

E. H. Looker, assistant engineer on the Cleveland, Cincinnati, Chicago & St. Louis, at Bellefontaine, Ohio, has been appointed assistant engineer maintenance of way of the Peoria & Eastern, with headquarters at Indianapolis, Ind.

L. S. Daynes, division engineer on the Western region of the Canadian National at Prince Albert, Sask., has been transferred to Kamloops, B. C. **W. E. Rivers,** division engineer at Edson, Alta., has been transferred to Prince Albert, to succeed Mr. Daynes.

A. W. White, assistant division engineer on the Chesapeake & Ohio, with headquarters at Shelby, Ky., has been transferred to Ashland, Ky., to succeed **J. G. Gilley,** whose appointment as supervisor of track is noted elsewhere in these columns.

B. J. Showen, draftsman in the office of the engineer maintenance of way of the Chicago, Rock Island & Pacific, with headquarters at El Reno, Okla., has been promoted to resident engineer on the El Paso-Amarillo division with headquarters at Dalhart, Tex.

E. A. Matney, assistant engineer on the Chicago, Rock Island & Pacific, with headquarters at Dalhart, Tex., has been promoted to office engineer in the office of the engineer maintenance of way with headquarters at El Reno, Okla., to succeed **Fred P. Funda,** whose promotion to division engineer was noted in the February issue and whose

sketch appears elsewhere in these columns.

D. B. Packard has been appointed chief engineer of the Winston-Salem Southbound, with headquarters at Wilmington, N. C., succeeding **D. W. Gross,** deceased.

S. B. Wass, terminal engineer on the construction of the Toronto (Ont.) viaduct of the Canadian National, has been given jurisdiction over that portion of the Montreal (Que.) terminal

S. B. Wass

outside of the central station area, as assistant to **C. B. Brown,** chief engineer in general charge of the project. Since Mr. Wass was graduated from Toronto University in 1903, he has been engaged in railroad engineering almost continuously. He entered the service of the Canadian Government Railways (now part of the Canadian National) in 1914, and since 1920, his duties have been in connection with terminal construction and rearrangements. He was in charge of the construction of the terminal facilities at Moncton, N. B., during 1920-21, and the construction of the new terminal and gravity yard at Noebing, near Fort William, Ont., which have been an important factor in the rapid and efficient handling of grain. In 1924, he was appointed terminal engineer in charge of the Toronto viaduct which included a large grading operation in addition to locomotive and terminal facilities.

Fred P. Funda, whose promotion to division engineer of the Arkansas-Louisiana division of the Chicago, Rock Island & Pacific, with headquarters at Little Rock, Ark., was noted in the February issue, was born on December 16, 1889, at New Prague, Minn., and graduated from Oklahoma ,State college in 1910, with a degree in civil engineering. He entered railway service immediately with the Rock Island and has been with that company continuously except for a time during the World War, and from 1923 to 1926, when he was in Cuba. His first position was as a material accountant in the district accounting office at El Reno, Okla., where he remained until 1911, when he was made an assistant draftsman and estimator in the office of the district engineer at the same place. In 1913, he was appointed chief draftsman in the office of the engineer maintenance of way at El Reno. From 1915 to 1916, Mr. Funda held the positions of rodman, levelman and instrumentman in the division engineer's office at El Reno, being on the latter date promoted to assistant engineer on the Arkansas division, with headquarters at Little Rock, Ark. He left the service of the Rock Island in 1918, to join the army, where he was with Company E of the 32d Engineers, on detached service with the base engineer's office, Bordeaux, France. Mr. Funda returned to the Rock Island in 1919, as an instrumentman at Little Rock and during the next three years he served as masonry inspector and assistant engineer at that point, being promoted in 1922 to acting division engineer at Little Rock, which position he held until 1923, when he went to Cuba as principal assistant engineer of the Cuba Railway, with headquarters at Camaguey. In March, 1926, he returned to the Rock Island as an instrumentman at Little Rock, serving in that position and as assistant engineer until September, 1929, when he was promoted to office engineer for the district engineer maintenance of way at El Reno, which position he was holding at the time of his promotion to division engineer, effective January 15.

David Davis, Jr., whose promotion to division engineer on the Pennsylvania, with headquarters at Elmira, N. Y., was noted in the March issue, was born on September 6, 1894, at Philadelphia, Pa. Mr. Davis was graduated from the University of Pennsylvania in 1915, and entered railway service on September 23 of that year as a draftsman in the valuation department of the Pennsylvania. On October 31, 1916, he was made a rodman on the Middle division and on March 1, 1917, he left the railroad to serve with the United States Army. On his return to railroad work on May 19, 1919, he was made assistant supervisor on the Alleghany division of the Pennsylvania, and served in that capacity on several divisions until February 1, 1927, when he was promoted to supervisor on the Williamsport division. On July 1, 1928, he was transferred to the Philadelphia division, and on November 1 of that year he was transferred to the Philadelphia Terminal division, where he was located at the time of his recent promotion to division engineer.

R. H. Crew, whose promotion to division engineer of the Akron division of the Pennsylvania, with headquarters at Akron, Ohio, was noted in the February issue, was born at Still Pond, Md., on March 29, 1893. After graduating from Swarthmore college in 1913, he entered railway service almost immediately with the Pennsylvania, as a rodman on the engineer corps of the New York division. Four years later he was promoted to transitman in the office of the chief engineer maintenance of way with headquarters at Philadelphia, Pa. On September 11, 1917, Mr. Crew left the service of the Pennsylvania on a leave of absence while he was on overseas duty with the 25th Engineers and the Transportation Corps. On September 8, 1919, he returned to the Pennsylvania as an assistant supervisor of track on the Atlantic division, at Camden, N. J., then being transferred to the New York division at Trenton, N. J., on July 15, 1920; to the Sunbury division at Wilkes-Barre, Pa., on January 10, 1921, and to the Middle division at Huntingdon, Pa., on March 16, 1921. He was promoted to supervisor of track on the Buffalo division, with headquarters at Strouthers, Pa., on April 6, 1926, then being transferred to the Pittsburgh division with headquarters at East Liberty, Pa., on March 1, 1928. On August 1, 1929, Mr. Crew was promoted to assistant division engineer of the Philadelphia division, with headquarters at Harrisburg, Pa., which position he was holding at the time of his promotion to division engineer, effective December 16, 1929.

P. D. Fitzpatrick, chief engineer of the Central Vermont, with headquarters at St. Albans, Vt., has been appointed assistant chief engineer on the Canadian National, in charge of the construction of the Montreal terminal. Mr. Fitzpatrick was born in Springfield, Ill., and received his higher education at Armour Institute, Chicago. He commenced his railway career with the Chicago & North Western in 1894, and served on track elevation work from that time until 1897, when he entered the service of the Illinois Central. While with this road, he held

P. D. Fitzpatrick

the position of assistant engineer, with headquarters at Chicago and at Louisville, Ky. In 1905, he left this road to become superintendent and engineer with a railroad construction concern. Seven years later, he became an assistant engineer on the construction of the Kansas City (Mo.) terminal, and in May, 1913, he joined the engineering staff of the Grand Trunk Western, a subsidiary of the Canadian National on the construction of a terminal at Bay

City, Mich. In October of the same year he was transferred to the Southern New England as division engineer in charge of the construction of this Grand Trunk project. In February, 1916, he was appointed valuation engineer of the Central Vermont, another subsidiary of the Canadian National, with headquarters at St. Albans, and in July of that year he was assigned the added duties of general roadmaster. He held these positions until 1918, when he was appointed chief engineer, the position he was holding at the time of his recent appointment to the Canadian National engineering staff, at Montreal, Que.

John G. Sheldrick, whose promotion to engineer maintenance of way of the Minneapolis, St. Paul & Sault Ste. Marie, with headquarters at Minneapolis, Minn., was noted in the March issue, has been connected with the engineering department of that road for nearly 24 years. He was born at Minneapolis on May 3, 1880, and entered railway service in May, 1898, as a chainman in the engineering department of the Chicago, St. Paul, Minneapolis & Omaha. Later he was advanced to rodman, and to masonry inspector, then entering the service of the Soo line in May, 1903, as a rodman. In the following year he became a bridge inspector and during the construction season of 1905, he was promoted to resident engineer in charge of the construction of two 12-mile sections of line. Mr. Sheldrick was appointed assistant engineer on general engineering department maintenance work in 1906, later being appointed resident engineer at Superior, Wis., where he remained until August, 1917, when he became manager of two eastern Ohio bituminous coal mines. He re-entered railway service on March 1, 1920, as resident engineer on the Soo line at Minneapolis, his promotion to engineer maintenance of way becoming effective on February 1.

Edward W. Backes, assistant division engineer of the Boston & Maine, with headquarters at Brattleboro, Vt., has been promoted to division engineer of the Connecticut River division, with headquarters at Springfield, Mass., to succeed **H. C. Archibald,** who has been transferred to the Portland division, with headquarters at Dover, N. H., where he replaces **John F. Collins,** who has been transferred to the Fitchburg division, with headquarters at Greenfield, Mass., to succeed **Samuel P. Coffin,** resigned.

Mr. Archibald, whose promotion to division engineer at Springfield was noted, in February, was born on July 26, 1891, at Everett, Mass., and received his higher education at Tufts College, from which he was graduated in 1915. He entered railway service with the Boston & Maine on June 15, 1915, as a structural draftsman and designer, and continued in this capacity, interrupted only by overseas duty with the 71st Artillery, until January, 1925, when he was promoted to supervisor of bridges and buildings on the Worcester, Nashua and Portland division, with headquarters at Nashua, N. H. In September, 1925, when the W. N. & P. division was abolished, Mr. Archibald was appointed assistant supervisor bridges and buildings of the Mountains division, with headquarters at Lawrence, Mass., and in April, 1927, he was made supervisor of bridges and buildings of the same division, with headquarters at Salem, Mass. In January, 1928, he was promoted to acting division engineer of the White Mountains division, with headquarters at Woodsville, N. H., and from May, 1928, to February, 1929, because of the abolition of the White Mountains division, he was made supervisor of bridges and buildings, assigned to special work. In February, 1929, he was made assistant division engineer of the Fitchburg division, with headquarters at Fitchburg, Mass., and in November he was made acting division engineer of the Connecticut River division, which position he was holding at the time of his recent promotion to division engineer.

John S. Goodman, division engineer of the Reading division of the Reading, with headquarters at Reading, Pa., has

John S. Goodman

been appointed superintendent of the Atlantic City Railroad (a subsidiary of the Reading) with headquarters at Camden, N. J. Mr. Goodman was born on March 17, 1884, at Philadelphia, Pa. He was graduated from Bucknell University in 1903, and from the University of Pennsylvania in 1906. On July 1, 1906, Mr. Goodman commenced his railway career with the Reading as assistant supervisor on the New York division. In November, 1907, he was transferred to Lansdale, Pa., and in April, 1909, he was appointed supervisor at Boiling Springs, Pa. On December 12, 1910, he became a supervisor on the New York division, with headquarters at Olney, Pa. On January 1, 1912, he was promoted to division engineer and served in this capacity on the Harrisburg, Shamokin and Reading divisions until his recent appointment as superintendent of the Atlantic City Railroad on February 1.

Track

W. S. Spencer, supervisor of track on the Chesapeake & Ohio, with headquarters at Barboursville, W. Va., has retired from active service.

T. F. Hyson, roadmaster on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Dubuque, Iowa, has been transferred to Des Moines, Iowa.

William Peterson has been appointed roadmaster on the Michigan Central, with headquarters at Kalamazoo, Mich., to succeed **M. Burns,** who is retiring after 50 years' service.

J. G. Gilley, assistant division engineer on the Chesapeake & Ohio, with headquarters at Ashland, Ky., has been appointed supervisor of track with headquarters at Martin, Ky.

W. E. Young, roadmaster on the Missouri Pacific, with headquarters at Beaumont, Tex., has been transferred to Lake Charles, La., to replace **J. R. Pinkerton,** who has been in turn transferred to Beaumont.

J. P. Davis, engineer maintenance of way of the Central Indiana, with headquarters at Anderson, Ind., has been appointed supervisor of track of the White River division of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Connersville, Ind.

George C. Bailey, assistant engineer of maintenance of way of the Kentucky & Indiana Terminal, with headquarters at Louisville, Ky., has been appointed roadmaster with the same headquarters to succeed **James McDonald,** whose death is noted elsewhere in these columns.

J. W. Swartz has been appointed supervisor on the Illinois Central, with headquarters at Litchfield, Ill., to succeed **W. N. Cramer,** who has been appointed assistant engineer with headquarters at Clinton, Ill., to replace **F. T. Kraft,** who has been appointed supervisor at the same place to succeed **M. Doyle,** who has retired.

Thomas Deighton, whose promotion to general roadmaster of the Great Northern, Lines East, was noted in the March issue, has been with that company for more than 32 years. He was born at Massillon, Ohio, on November 6, 1875, and entered the service of the Great Northern in November, 1897, as a track man, which position he held until 1899, when he was promoted to assistant extra gang foreman. A year later he was promoted to track foreman and served in this capacity and as an extra gang foreman until 1910, on which date he was appointed assistant roadmaster, being promoted to division roadmaster in 1915. Mr. Deighton was holding this position at the time of his promotion to general roadmaster, effective February 1.

E. L. Brown, assistant on the engineer corps of the Pittsburgh division of the Pennsylvania, has been promoted to assistant supervisor on the Conemaugh division with headquarters at Blairs-

ville, Pa., to succeed **C. E. Ballard,** who has been transferred to the Panhandle division where he replaces **J. C. Buzard,** who has been promoted to supervisor on the Buffalo division, with headquarters at Titusville, Pa. Mr. Buzard succeeds **C. J. Henry,** who has been transferred to the Erie and Ashtabula division, with headquarters at Niles, Ohio, to replace **E. Glavin,** who has been transferred to the Eastern division, with headquarters at Canton, Ohio, where he replaces **C. P. Sipe,** who goes to the Erie and Ashtabula division as supervisor at Sharon, Pa. Mr. Sipe replaces **G. A. Sawyer,** who has been transferred to the Maryland division, with headquarters at Chester, Pa.

D. A. Sipe, assistant supervisor on the Pittsburgh division of the Pennsylvania, with headquarters at East Liberty, Pa., has been promoted to supervisor on the Buffalo division, with headquarters at Olean, N. Y., to succeed **J. L. Conover,** who has been assigned to other duties. **N. J. Allinger,** assistant supervisor on the Western region, has been transferred to East Liberty to succeed Mr. Sipe.

A. A. Pogue, whose promotion to supervisor on the Louisville & Nashville, with headquarters at Paris, Ky., was noted in the March issue, was born on February 22, 1892, at Normandy, Tenn., and graduated from the high school at Birmingham, Ala., in 1910. On November 12, 1911, he entered railway service with the Birmingham Southern as a rodman in the engineering department and served in this capacity and as an instrumentman until November 12, 1912, when he became a rodman on the Louisville & Nashville, with which road he has remained continuously. In April, 1913, he was promoted to levelman and seven months later, to instrumentman. In August, 1923, Mr. Pogue was promoted to assistant engineer, which position he was holding at the time of his appointment as track supervisor, effective February 1.

Bridge and Building

F. C. Bernard, bridge and building foreman on the Missouri Pacific, has been promoted to supervisor of bridges and buildings with headquarters at Monroe, La., to succeed **A. C. Roberts,** who has been promoted to chief bridge inspector with headquarters at St. Louis, Mo.

H. M. Smith, whose promotion to supervisor of bridges and buildings on the Montgomery district of the Mobile & Ohio, at Tuscaloosa, Ala., was noted in the March issue, was born on October 2, 1882, at Vida, Ala., and was educated in the public schools of that place. He entered railway service with the M. & O. as a bridge laborer on March 15, 1910, and was promoted to assistant bridge foreman on May 1, 1914. He was further promoted to bridge foreman on December 1, 1917, which position he was holding at the time of his promotion to supervisor of bridges and buildings, effective January 1.

Seth E. Newling, assistant carpenter foreman of a floating crew on the Boston & Maine, has been promoted to assistant supervisor of bridges and buildings, with headquarters at Dover, N. H. Mr. Newling succeeds **F. C. Brackett,** whose promotion to supervisor of bridges and buildings was noted in the March issue.

Mr. Brackett was born on November 16, 1888, at Wells, Me., and was graduated from the Standish High School of that city in 1908. He entered railway service with the Maine Central as a bridgeman in October, 1909, and in December, 1912, he was promoted to assistant foreman of bridges. In October, 1916, he was promoted to foreman of bridges and in June, 1929, he left the Maine Central to become general foreman of the maintenance of way shops on the Boston & Maine. In September of the same year, he was promoted to assistant supervisor of bridges and buildings, with headquarters at Dover, N. H., which position he was holding at the time of his recent promotion to supervisor of bridges and buildings.

Special

V. Irving Smart, general superintendent of transportation of the Western region of the Canadian National and formerly engineer of maintenance of way of the Chicago & Eastern Illinois, has been appointed deputy commissioner of railways of Canada to succeed **R. A. C. Henry,** who has resigned to become vice-president of the Beauharnois Light, Heat & Power Company, Montreal. Mr. Smart will be also the government director on the board of the Canadian National. He was born at Brockville, Ont., on Feb-

V. Irving Smart

ruary 14, 1876, and graduated from Queen's university. During portions of 1897-1898, he was engaged in surveys for the Dominion government and, from 1900 to 1902, he was an assistant engineer on the Illinois Central, being in the latter year promoted to assistant signal engineer. He left the Illinois Central in 1904, to become signal engineer of the Chicago & Eastern Illinois, being in 1905, promoted to engineer maintenance of way of that road. In 1907, he became professor of railway engineering and operation at McGill university, Montreal, Que., which position he held until 1914, when he was appointed vice-president and general manager of the General Railway Signal Company. Mr. Smart left

R. A. C. Henry

this company in 1917 to become a consulting engineer at Montreal, being appointed consulting engineer of the Department of Railways and Canals of Canada, in 1920. In April, 1923, he entered the service of the Canadian National as a special engineer and was appointed general superintendent of transportation of the Western region in September, 1928, which position he was holding at the time of his recent appointment to the government position.

Mr. Henry, who has been given recognition as a transportation expert, served in the engineering department of the Canadian Pacific in his younger years. He was born at Montreal, Que., in 1884, and graduated from McGill University with the degrees of B. A. and B. Sc., then joining the engineering forces of the western lines of the C. P. R. as a chainman, being promoted through various positions to that of assistant engineer. From 1908 to 1909, he was with the government in the Department of the Interior and from 1910 to 1911, he was superintendent on various construction projects. In May, 1912, he joined the Department of Railways and Canals, where he served as inspecting engineer, assistant engineer, general assistant engineer and engineer in charge of the Grand Trunk Arbitration.

Purchases and Stores

P. E. Welch has been appointed district storekeeper on the Southern Pacific Lines in Texas and Louisiana, with headquarters at Algiers, La., to succeed **N. Feigel,** who has been transferred to Houston, Tex. Mr. Feigel succeeds **W. E. Rawson,** who has been promoted to assistant general storekeeper with headquarters at Houston, Tex.

W. A. Summerhays has been appointed manager, forest products in-

spection and research bureau of the Illinois Central, with headquarters at Memphis, Tenn., and the position of lumber and tie agent at Chicago, which he formerly held, has been abolished. The purchase of lumber and ties was placed under the supervision of **J. J. Bennett**, purchasing agent, on March 1.

Obituary

P. N. Watson, retired supervisor of bridges and buildings on the Maine Central, died on February 10. Mr. Watson's home was at Brunswick, Me.

James McDonald, roadmaster on the Kentucky & Indiana Terminal, with headquarters at Louisville, Ky., was killed in an accident on January 29.

Nicholas Schiffley, retired assistant supervisor of track on the New York Central, died at his home at Bryan, Ohio, on February 1, at the age of 67 years.

John Lehr, assistant supervisor of track on the Western division of the New York Central, with headquarters at La Porte, Ind., died at that city on January 15.

Isaac G. Wheeler, retired supervisor of bridges and buildings on the New York Central, died at his home in Allston, Mass., on February 12, at the age of 91 years.

Joseph Mott, retired roadmaster on the San Joaquin division of the Southern Pacific, with headquarters at Ventura, Cal., died on January 6, at the age of 87 years.

John Gude, principal assistant engineer in the office of the chief engineer of the Southern Pacific Lines in Texas and Louisiana, with headquarters at Houston, Tex., died on February 26.

Clifton S. Thompson, retired engineer of bridges and buildings of the Denver & Rio Grande Western, died at his home at Denver, Colo., on March 11, at the age of 77.

C. D. Olson, a former roadmaster on the Los Angeles & Salt Lake, with headquarters at Kelso, Cal., died at his home at Los Angeles, Cal., on January 25. Mr. Olson left the employ of the L. A. & S. L. in 1924, to become associated with the Los Angeles Gas & Electric Co.

Henry Holgate, a former construction engineer for the Canadian Northern (now part of the Canadian National) and a prominent consulting engineer, died at his home at Montreal, Que., on January 22. Mr. Holgate was one of the two engineers who recently submitted a report to the Montreal Board of Trade, which condemned the St. Lawrence Waterway project as impractical.

P. H. Nugent, roadmaster on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Green Bay, Wis., died on January 18, at his home in that city, after having served on one division of that road for 58 years. He was born on August 22, 1857, at Sherman, Wis., and began his railway career in 1871, as a trackman on the Milwaukee & Northern (now part of the C. M. St. P. & P.). He later became a track foreman and in 1880, he was promoted to roadmaster of the territory between North Milwaukee, Wis., and Green Bay, including the branch lines, which position he held until his death.

Samuel M. Felton, chairman of the board of the Chicago Great Western and an engineer by early training, died on March 11 at the Passavant hospital,

Samuel M. Felton

Chicago, after a lingering illness. Mr. Felton had been connected with railroads of this country in various executive capacities for nearly 62 years. He was born on February 3, 1853, at Philadelphia, Pa., and at the age of 15 years he entered railway service with the Chester Creek (now part of the Reading) as a rodman. He was promoted successively to levelman, assistant engineer and engineer in charge of surveys, and in 1873, at the age of 20, was appointed chief engineer of the Chester & Delaware River.

In 1874, Mr. Felton left this road to become general superintendent of the Pittsburgh, Cincinnati & St. Louis (now part of the Pennsylvania). He was appointed general manager of the New York & New England in 1882, and assistant to the president in 1884, being in 1885 appointed vice-president in charge of traffic of the New York, Lake Erie & Western (now the Erie). In November, 1890, he became president of the East Tennessee, Virginia & Georgia (now part of the Southern). From this time Mr. Felton held positions as chairman of the board of directors, receiver or president on several roads in this country and Mexico, including the Cincinnati, New Orleans & Southern (now part of the Southern); the Alabama Great Southern (now also part of the Southern); the Columbus, Sandusky & Hocking (now part of the Pennsylvania and the New York Central); the Chicago & Alton; the Mexican Central (now part of the National Railways of Mexico), and the Pere Marquette. When the office of director-general of military railways was established in July, 1917, Mr. Felton was appointed to that position by the secretary of war. He was elected president of the Chicago Great Western in August, 1904, and held that position continuously until November 2, 1925, when he was elected chairman of the board of directors, which position he held until his death.

Alexander C. Shand, retired assistant to the vice-president of the Pennsylvania and formerly chief engineer of that road, died at Germantown, Pa., on March 9, at the age of 72 years. Mr. Shand was born on July 1, 1858, at Lesmahagow, Scotland, and was educated at Anderson University, Glasgow. He entered railway service in 1879, on location and construction work on the Pennsylvania at Connellsville, Pa., and shortly after was placed in charge of the construction of the Torrens shops. From February, 1882, to August, 1884, he was an assistant supervisor and engineer in charge of the location and construction of branches on the Southwest Pennsylvania (now part of the Pennsylvania), and at the latter time was promoted to supervisor of the Altoona yard of the Pennsylvania. In 1899, he was promoted to assistant engineer maintenance of way at Altoona, and on August 1, 1890, he was further promoted to principal assistant engineer at Altoona. In January, 1901, he entered the operating department as superintendent of the Altoona division, which position he held until June 1, 1903, when he returned to the engineering department as engineer maintenance of way with headquarters at Philadelphia. On April 1, 1905, he was promoted to assistant chief engineer, and on March 1, 1906, he was further promoted to chief engineer of the lines

Alexander C. Shand

east of Pittsburgh, Pa., and Erie, holding this position until March 1, 1920, when he was promoted to chief engineer of the system, with headquarters at Philadelphia. On February 1, 1927, Mr. Shand was promoted to the newly created position of assistant to vice-president, in which capacity he was assigned to special engineering duties in connection with the plans for the new Philadelphia passenger station, which position he was holding at the time of his retirement on August 1, 1928.

Classified Advertisements

Use this section when seeking a new man, a new position, or when buying or selling second-hand equipment.

CLASSIFIED ADVERTISEMENTS, $10.00 an inch, one inch deep by three inches wide, an insertion.

EMPLOYMENT ADVERTISEMENTS, 10 cents a word a month, including address, minimum charge $2.00.

Remittance must accompany each order.

Railway Engineering and Maintenance
Classified Department
105 West Adams Street, Chicago

Wanted: Young man, preferably unmarried, with railroad maintenance experience, for service department with well-known railroad supply concern. Good opportunity for advancement. Address Box 302 Railway Engineering and Maintenance, 105 W Adams St., Chicago, Ill.

CLASSIFIED INDEX TO ADVERTISERS

Acetylene Dissolved
Oxweld Railroad Service Company
Adzing Machine
Nordberg Mfg. Co.
Air Compressors
Chicago Pneumatic Tool Co.
Fairbanks, Morse & Co.
Gardner-Denver Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Air Generator Set
Buda Co.
Air Hoists
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Air Lift Pumping Machinery
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Airport Drainage
Armco Culvert Mfrs. Assn.
Aluminum Markers
Premax Products, Inc.
Anti-Creepers, Rail
American Fork & Hoe Co.
Bethlehem Steel Co.
Coover Railroad Track Brace Co.
Lundie Engineering Co.
P. & M. Co.
Verona Tool Works
Woodings Forge & Tool Co.
Asphalt
Barber Asphalt Co.
Backfillers
Buckeye Traction Ditcher Co.
Backfiller Cranes
Buckeye Traction Ditcher Co.
Ballast Cleaners
Industrial Brownhoist Corp.
Ballast Screens
Maintenance Equipment Co.
Ballast Spreaders
Jordan Co., O. F.
Ballast Trimmers
Jordan Co., O. F.
Ballaster, Power
Maintenance Equipment Co.
Bank Builders
Jordan Co., O. F.
Bank Slopers
Jordan Co., O. F.
Band Saws
American Saw Mill Machinery Co.
Bars
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company
Bearings, Axle
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Bearings, Roller
Timken Roller Bearing Co.
Bearings, Tapered Roller; Thrust and Journal Box
Timken Roller Bearing Co.
Benders, Rail
See Rail Benders
Bolts
Bethlehem Steel Co.
Illinois Steel Co.
Bonding Outfits, Rail
Chicago Pneumatic Tool Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Braces, Track
Coover Railroad Track Brace Co.
Ramapo Ajax Corp.
Bridge Floors
Armco Culvert Mfrs. Assn.
Illinois Steel Co.
Bridge Warnings
Hastings Signal & Equipment Co.
Buckets
Industrial Brownhoist Corp.
Buckets, Clam Shell
Cullen-Friestedt Co.
Industrial Brownhoist Corp.
Building Beams, Concrete
Federal Cement Tile Co.
Massey Concrete Products Corp.
Building Papers
Barber Asphalt Co.
Bumping Posts
Buda Co.
Louisville Frog, Switch & Signal Co.
Mechanical Mfg. Co.
Calcium Carbide
Oxweld Railroad Service Co.
Car Replacers
American Chain Co., Inc.
Louisville Frog, Switch & Signal Co.
Car, Spreader
Jordan Co., O. F.
Car Stop, Friction
Maintenance Equipment Co.
Cars, Ballast
See Ballast Cars
Cars, Dump
See Dump Cars
Cars, Hand
Buda Co.
Fairbanks, Morse & Co.
Fairmont Ry. Motors, Inc.
Kalamazoo Ry. Supply Co.
Northwestern Motor Co.
Cars, Industrial
Koppel Industrial Car & Equipment Co.
Magor Car Corp.
Cars, Inspection
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.
Cars, Motor
Buda Co.
Fairbanks, Morse & Co.
Fairmont Ry. Motors, Inc.
Kalamazoo Ry. Supply Co.
Northwestern Motor Co.
Woolery Machine Co.
Cars, Section
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply
Northwestern Motor Co.
Woolery Machine Co.
Cars, Velocipede
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Castings
Bethlehem Steel Co.
Louisville Frog, Switch & Signal Co.
Timken Roller Bearing Co.
Wharton, Jr. & Co., Inc., Wm.
Catchbasins
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.
Cattle Guards
Fairbanks, Morse & Co.
Kalamazoo Railway Supply Co.
Cattle Passes
Massey Concrete Products Corp.
Cement Repair
Barber Asphalt Co.
Cement Roofing Tile
Federal Cement Tile Co.
Chemical Weed Killer
Chipman Chemical Engineering Co., Inc.
Clay Diggers
Buckeye Traction Ditcher Co.
Clips, Adjustable
Ramapo Ajax Corp.
Coal Handling Machinery
Industrial Brownhoist Corp.
Northwest Engineering Co.
Coal Handling Plants and Apparatus
Gifford-Wood Co.
Coaling Stations
Fairbanks, Morse & Co.
Chicago Bridge & Iron Works
Compressors
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Compromise Joints
See Joints, Compromise
Concrete Roofing Tile
Federal Cement Tile Co.
Concrete Units, Miscellaneous
Federal Cement Tile Co.
Massey Concrete Products Corp.
Condensers
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Ingersoll-Rand Co.
Corrosion Preventive
Dearborn Chemical Co.
Corrugated Iron
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.
Cranes, Barge, Electric Erecting, Gantry, Locomotive Pillar, Revolving Transfer, Tractor, Tractor Crawling, Tunnel, Wharf and Wrecking
Buckeye Traction Ditcher Co.
Bucyrus-Erie Co.
Cullen-Friestedt Co.
Harnischfeger Corp.
Industrial Brownhoist Corp.
Northwest Engineering Co.
Orton Crane & Shovel Co.
Cribbing, Concrete
Federal Cement Tile Co.
Massey Concrete Products Corp.
Crossing Gates
Buda Co.
Kalamazoo Railway Supply Co.
Crossing Protection Barrier
Franklin Railway Supply Co.
Crossings, Highway
Barber Asphalt Co.
Crossings, Rail
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.
Crossings, Reconditioning
Morrison Railway Supply Corp.
Culvert Pipe
Armco Culvert Mfrs. Assn.
Massey Concrete Products Corp.
Toncan Culvert Mfrs. Assn.
U. S. Cast Iron Pipe & Fdry. Co.
Culverts, Corrugated Metal
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.
Culverts, Paved Invert
Armco Culvert Mfrs. Assn.
Curbing
Massey Concrete Products Corp.
Derails
American Chain Co., Inc.
Q. & C. Co.
Wharton Jr. & Co., Wm
Derailing Switches
Ramapo Ajax Corp.
Derrick Cars
Cullen-Friestedt Co.
Maintenance Equipment Co.
Diesel Engines
Buda Co.
Chicago Pneumatic Tool Co.
Fairbanks, Morse & Co.
Ingersoll-Rand Co.
Diesel Electric Power Plants
Fairbanks, Morse & Co.
Ingersoll-Rand Co.
Discing Machines
Fairmont Railway Motors, Inc.
Disinfectants
Chipman Chemical Engineering Co., Inc.
Ditchers, Curb
Buckeye Traction Ditcher Co.
Ditchers, Drainage
Buckeye Traction Ditcher Co.
Bucyrus-Erie Co.
Harnischfeger Corp.
Jordan Co., O. F.
Northwest Engineering Co.
Ditchers, Open
Buckeye Traction Ditcher Co.
Ditchers, Tile
Buckeye Traction Ditcher Co.
Doors
Richards-Wilcox Mfg. Co.
Draglines
Northwest Engineering Co.
Drainage Gates
Armco Culvert Mfrs. Assn.
Drains, Perforated
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.
Drills, Earth
Buda Co.
Drills, Pneumatic
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Drills, Rock
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Verona Tool Works
Drill Steel, Rock
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Drills, Track
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Kalamazoo Railway Supply Co.
Dump Cars
Differential Steel Car Co.
Jordan Co., O. F.
Magor Car Corp.
Electric Cranes (Locomotive, Pillar, Transfer & Wrecking)
See Cranes
Electric Light and Power Plants
Fairbanks, Morse & Co.
Electric Power Units
Northwestern Motor Co.
Syntron Co.
Electric Snow Melters
Lundie Engineering Corp.
Q. & C. Co.
Electric Welding
Electric Railweld Sales Corp.
Engines, Gasoline
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Engines, Motor Car
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motor Co.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.
Engines, Oil
Buda Co.
Chicago Pneumatic Tool Co.
Fairbanks, Morse Co.
Fairmont Railway Motors, Inc.
Ingersoll-Rand Co.
Excavators
Buckeye Traction Ditcher Co.
Bucyrus-Erie Co.
Harnischfeger Corp.
Northwest Engineering Co.
Fences
American Steel & Wire Co.
Anchor Post Fence Co.
Page Fence Association
Q. & C. Co.
Fence Fabric
American Steel & Wire Co.
Anchor Post Fence Co.
Page Fence Association
Fence Posts
American Steel & Wire Co.
Massey Concrete Products Corp.
Q. & C. Co.
Fibre angle pieces, bushings, plates, end posts, etc.
Q. & C. Co.
Fibre insulation
Q. & C. Co.
Filters (pressure and gravity)
Graver Corp.
Flange Lubricators
Maintenance Equipment Co.
Flangers, Snow
Q. & C. Co.
Flangeway Guard
Bethlehem Steel Co.
Float Valves
Fairbanks, Morse & Co.
Floating Roofs
Chicago Bridge & Iron Works
Flood Lights
Oxweld Railroad Service Co.
Floor Coverings
Barber Asphalt Co.
Forging Hammers
Industrial Brownhoist Corp.
Forgings
Bethlehem Steel Co.
Carnegie Steel Co.
Frogs
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Inc., Wm.
Frogs, Reconditioning
Morrison Railway Supply Corp.
Gages, Measuring
Lufkin Rule Co.
Gages, Pressure Gas
Oxweld Railroad Service Co.
Fumigants
Calcyanide Co.
Gas, Acetylene
Oxweld Railroad Service Co.
Gas Switch Heaters
Ruby Railway Equipment Co.
Gates, Drainage
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.
Generators, Acetylene-Carbic
Oxweld Railroad Service Co.
Grading Machinery
Bucyrus-Erie Co.
Graphite
U. S. Graphite Co.
Grease, Track
U. S. Graphite Co.
Grinders, Portable
Buda Co.
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Guard Rails
American Chain Co., Inc.
Bethlehem Steel Co.
Buda Co.
Carnegie Steel Co.
Q. & C. Co.
Ramapo Ajax Corp.
Pettibone Mulliken Co.
Guard Rail Clamps
American Chain Co., Inc.
Bethlehem Steel Co.
Buda Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.
Hammers, Chipping, Scaling and Caulking
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Hammer Drills
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Hammers, Forge
Sullivan Machinery Co.
Hammers, Riveting
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Hand Car Bearings
Timken Roller Bearing Co.
Hangers, Door
Richards-Wilcox Mfg. Co.
Head Drains, Perforated
Toncan Culvert Mfrs. Assn.
Heaters, Feed Water
Graver Corp.
Heel Blocks
Bethlehem Steel Co.
Highway Crossing Barrier
Franklin Railway Supply Co.
Hoisting Machinery
Fairbanks, Morse & Co.
Gardner-Denver Co.
Gifford-Wood Co.
Industrial Brownhoist Corp.
Ingersoll-Rand Co.
Hoists, Air Motor
Chicago Pneumatic Tool Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Hose
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
House Lining
Barber Asphalt Co.
Ice Cutters
Economy Railway Appliance Co., Ltd.
Jordan Co., O. F.
Ice Cutting Attachments
Economy Railway Appliance Co., Ltd.
Insecticides
Calcyanide Co.
Inspection, Engineering
Hunt Co., Robert W.
Insulated Rail Joints
Bethlehem Steel Co.
Q. & C. Co.
Rail Joint Co.
Insulating Material
Barber Asphalt Co.
Insulating Varnish
General Electric Co.
Jacks, Bridge
Buda Co.
Kalamazoo Railway Supply Co.
Jacks, Track
Buda Co.
Kalamazoo Railway Supply Co.
Verona Tool Works
Joints, Compromise
American Chain Co., Inc.
Bethlehem Steel Co.
Q. & C. Co.
Rail Joint Co.
Joint Fastenings
Illinois Steel Co.
Joint, Rail
American Chain Co., Inc.
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company
Q. & C. Co.
Rail Joint Co.
Wharton Jr. & Co., Wm.
Joints, Step
American Chain Co., Inc.
Illinois Steel Company
Q. & C. Co.
Rail Joint Co.
Junction Boxes
Massey Concrete Products Corp.
Knuckles, Emergency
Q. & C. Co.
Lacquers
General Electric Co.
Lead, Red
National Lead Co.
Line Pipe
Naylor Pipe Co.
Liners, Track
Buda Co.
Rail Joint Co.
Lock Washers
Louisville Frog, Switch & Signal Co.
National Lock Washer Co.
Reliance Manufacturing Co.
Verona Tool Works

CLASSIFIED INDEX TO ADVERTISERS—(Continued)

Locomotives, Oil Engine Electric Driven
Ingersoll-Rand Co.

Manganese Track Work
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Manholes
Massey Concrete Products Corp.

Markers
Massey Concrete Products Corp.
Premax Products, Inc.

Mile Posts
Massey Concrete Products Corp.

Motor Bearings
Timken Roller Bearing Co.

Motors and Generators
Fairbanks, Morse & Co.

Mowing Machines
Fairmont Railway Motors, Inc.

Number Plates
Premax Products, Inc.

Non-Derailer
Ramapo Ajax Corp.

Nut Locks
Dardalet Threadlock Co.
National Lock Washer Co.
Reliance Manufacturing Co.
Verona Tool Works
Woodings Forge & Tool Co.

Nuts
Bethlehem Steel Co.
Dardalet Threadlock Co.
Illinois Steel Co.

Oil, Snow Melting
Cook Co., Howard P.

Out Houses
Massey Concrete Products Corp.

Oxy-Acetylene Welding Equipment
Oxweld Railroad Service Co.

Oxygen
Oxweld Railroad Service Co.

Paint
National Lead Co.
U. S. Graphite Co.

Paint, Graphite
U. S. Graphite Co.

Paint, Metal Protecting
Barber Asphalt Co.
National Lead Co.
U. S. Graphite Co.

Pavement Breakers
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Penstocks
Fairbanks, Morse & Co.
Naylor Pipe Co.

Pile Drivers
Bucyrus-Erie Co.
Industrial Brownhoist Corp.
Ingersoll-Rand Co.

Piling
Carnegie Steel Co.
Jennison-Wright Co.
Massey Concrete Products Corp.
Southern Wood Preserving Co.

Pipe Carriers
Massey Concrete Products Corp.

Pipe, Cast Iron
Central Foundry Co.
U. S. Cast Iron Pipe & Foundry Co.

Pipe, Concrete
Massey Concrete Products Corp.

Pipe, Corrugated
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.

Pipe, Iron Alloy
Naylor Pipe Co.

Pipe, Sewer
Armco Culvert Mfrs. Assn.
Central Foundry Co.
Massey Concrete Products Corp.
Naylor Pipe Co.
Toncan Culvert Mfrs. Assn.

Pipe, Spiral
Naylor Pipe Co.

Pipe, Steel
Naylor Pipe Co.

Plants, Water Treating
Chicago Bridge & Iron Works
Graver Corp.

Plates, Miscellaneous
Ramapo Ajax Corp.

Plumbing Fixtures, Brass
Standard Sanitary Mfg. Co.

Plumbing Fixtures, Enameled
Standard Sanitary Mfg. Co.

Plumbing Fixtures, Vitreous China
Standard Sanitary Mfg. Co.

Poles
Jennison-Wright Co.
Massey Concrete Products Corp.
Southern Wood Preserving Co.

Post Hole Diggers
Buda Co.

Power Jack
Nordberg Mfg. Co.

Power Plants, Portable
Northwestern Motor Co.
Syntron Co.

Preservation, Timber
Jennison-Wright Co.
Southern Wood Preserving Co.

Products, Gas
Oxweld Railroad Service Co.

Pumps, Air Pressure & Vacuum, Centrifugal, Deep Well, Piston Plunger, Rotary, Slums
Chicago Pneumatic Tool Co.
Cook Co., A. D.
Fairbanks, Morse & Co.
Gardner-Denver Co.
Ingersoll-Rand Co.
Layne & Bowler, Inc.
Sullivan Machinery Co.

Push Cars
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.

Push Car Bearings
Timken Roller Bearing Co.

Rail Anchors
American Fork & Hoe Co.
Bethlehem Steel Co.
Coover Railroad Track Brace Co.
Lundie Engineering Corp.
P. & M. Co.
Verona Tool Works
Woodings Forge & Tool Co.

Rail Benders
American Chain Co., Inc.
Buda Co.
Q. & C. Co.
Verona Tool Works

Rail Bonds
American Steel & Wire Co.
Verona Tool Works

Rail Braces
Bethlehem Steel Co.
Buda Co.
Coover Railroad Track Brace Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr., & Co., Wm.

Rail Expanders
Ramapo Ajax Corp.

Rail Layers
Buckeye Traction Ditcher Co.
Cullen-Friestedt Co.
Maintenance Equipment Co.
Nordberg Mfg. Co.

Rail Saws, Portable
Industrial Brownhoist Corp.
Kalamazoo Railway Supply Co.

Rail Shims
American Fork & Hoe Co.

Rail Springs
Verona Tool Works

Rails, Girder
Bethlehem Steel Co.

Rails, Reconditioning
Morrison Railway Supply Corp.

Rails, Tee
Bethlehem Steel Co.
Carnegie Steel Co
Louisville Frog, Switch & Signal Co.

Regulators, Oxy-Acetylene
Oxweld Railroad Service Co.

Replacers, Car & Locomotive
American Chain Co., Inc.
Buda Co.

Retaining Walls, Precast
Federal Cement Tile Co.
Massey Concrete Products Corp.

Rivets
Bethlehem Steel Co.

Rock Hammers
Gardner-Denver Co.
Ingersoll-Rand Company

Rods, Welding
Oxweld Railroad Service Co.

Roof Slabs
Federal Cement Tile Co.
Massey Concrete Products Corp.

Roofing, Cement & Concrete Tile
Federal Cement Tile Co.

Roofing Composition
Barber Asphalt Co.

Ruins
Lufkin Rule Co.

Rust Preventive
Dearborn Chemical Co.

Saw Rigs
American Saw Mill Machinery Co.
Fairbanks, Morse & Co.

Saws, Electric
Reed-Prentice Corp.

Saws, High Speed Friction
American Saw Mill Machinery Co.

Saw Mills
American Saw Mill Machinery Co.

Saws, Portable, Rail
Q. & C. Co.

Saws, Timber
Reed-Prentice Corp.

Scales, Tape
Lufkin Rule Co.

Scales, Track
Fairbanks, Morse & Co.

Screw Spikes
Illinois Steel Company

Screw Spike Drivers
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.

Sharpeners, Rock Drill Steel
Gardner-Denver Co.
Ingersoll-Rand Co.

Sheathing Paper
Barber Asphalt Co.

Sheet Iron
Armco Culvert Mfrs. Assn.

Shingles, Composition
Barber Asphalt Co.

Shovels
Verona Tool Works
Woodings Forge & Tool Co.

Signals, Bridge & Warning
Hastings Signal & Equipment Co.

Siphons
Armco Culvert Mfrs. Assn.

Skid Excavators & Dredges
Northwest Engineering Co.

Skid Shoes
Q. & C. Co.

Slabs, Concrete
Massey Concrete Products Corp.

Smokestacks
Chicago Bridge & Iron Works
Massey Concrete Products Corp.

Snow Melting Device
Cook Co., Howard P.
Lundie Engineering Corp.
Q. & C. Co.
Ruby Railway Equipment Co.

Snow Plows
Jordan Co., O. F.
Q. & C. Co.

Spike Pullers
Independent Pneumatic Tool Co.

Spikes
Bethlehem Steel Co.
Illinois Steel Co.

Standpipes
Chicago Bridge & Iron Works.
Fairbanks, Morse & Co.

Stands, Switch & Target
Bethlehem Steel Co.
Ramapo Ajax Corp.
Q. & C. Co.

Steam Enclosures
Toncan Culvert Mfrs. Assn.

Steam Shovels
Bucyrus-Erie Co.
Harnischfeger Corp.
Northwest Engineering Co.
Orton Crane & Shovel Co.

Steel, Alloy
Central Alloy Steel Corp.
Illinois Steel Company

Steel Cross Ties
Carnegie Steel Co.

Steel, Electric Furnace
Timken Roller Bearing Co.

Steel, Open Hearth
Carnegie Steel Co.
Timken Roller Bearing Co.

Steel Plates and Shapes
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Steel, Special Analysis
Timken Roller Bearing Co.

Storage Tanks
Chicago Bridge & Iron Works.
Graver Corp.
Pittsburgh-Des Moines Steel Co.

Storm Sewers, Corrugated Iron
Armco Culvert Mfrs. Assn.

Stream Enclosures, Corrugated Iron
Armco Culvert Mfrs. Assn.

Street Culverts, Part Circle
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.

Structural Steel
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Switch Guard
Ramapo Ajax Corp.

Switchmen's Houses
Massey Concrete Products Corp.

Switches
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Switchpoint Protectors
Fleming Co.
Maintenance Equipment Co.

Switchpoint, Reconditioning
Morrison Railway Supply Corp.

Switchstands & Fixtures
Bethlehem Steel Co.
Buda Co.
Pettibone Mulliken Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Tampers, Tie
See Tie Tampers

Tanks & Fixtures
Fairbanks, Morse & Co.

Tanks, Fire Protection
Chicago Bridge & Iron Works

Tanks, Oil Storage
Chicago Bridge & Iron Works.
Graver Corp.

Tanks, Roadside Delivery
Chicago Bridge & Iron Works.

Tanks, Steel
Chicago Bridge & Iron Works
Graver Corp.
Pittsburgh-Des Moines Steel Co.

Tapes, Measuring
Lufkin Rule Co.

Telegraph Service, Long Distance
American Telephone & Telegraph Co.

Telephone Service, Long Distance
American Telephone & Telegraph Co.

Telltales
Hastings Signal & Equipment Co.

Testing of Materials
Hunt Co., Robert W.

Thawing Outfits
Cook Co., Howard P.
Lundie Engineering Corp.
Q. & C. Co.
Ruby Railway Equipment Co.

Ties
Jennison-Wright Co.
Southern Wood Preserving Co.

Tie Plate Clamps
Q. & C. Co.

Tie Plates
Bethlehem Steel Co.
Illinois Steel Co.
Lundie Engineering Corp.

Tie Rods
Bethlehem Steel Co.
Coover Railroad Track Brace Co.

Tie Scorer
Woolery Machine Co.

Tie Spacers
American Chain Co., Inc.
Maintenance Equipment Co.

Tie Tampers
Chicago Pneumatic Tool Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Syntron Co.

Tile, Roofing
Federal Cement Tile Co.

Timber, Creosoted
Jennison-Wright Co.
Southern Wood Preserving Co.

Tools, Oxy-Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Tools, Pneumatic
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.

Tools, Track
Buda Co.
Maintenance Equipment Co.
Q. & C. Co.
Verona Tool Works
Woodings Forge & Tool Co.

Tongue Switches
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. Co., Wm.

Torches, Oxy & Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Track Bolt Wrench
Independent Pneumatic Tool Co.

Track Cranes
Buckeye Traction Ditcher Co.
Cullen-Friestedt Co.
Nordberg Mfg. Co.

Track Gages
Buda Co.
Kalamazoo Railway Supply Co.
Verona Tool Works

Track Insulation
Q. & C. Co.

Track Levels
Kalamazoo Railway Supply Co.

Track, Special Work
Ramapo Ajax Corp.
Wharton, Jr., & Co., Wm.

Trestle Slabs
Massey Concrete Products Corp.

Trench Excavators, Pipe Line, Chain-and-Bucket Type, Wheel Type
Buckeye Traction Ditcher Co.

Trucks, Hand Steel
Anchor Post Fence Co.

Tubing, Seamless Steel
Timken Roller Bearing Co.

Tunnel Warnings
Hastings Signal & Equipment Co.

Undercrossings, Corrugated Iron
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.

Ventilators
Q. & C. Co.

Warning Devices, Bridge & Tunnel
Hastings Signal & Equipment Co.

Water Columns
Fairbanks, Morse & Co.

Water Cranes
Fairbanks, Morse & Co.

Water Softening Plants
Graver Corp.

Water Supply Contractors
Layne & Bowler, Inc.

Water Tanks
Chicago Bridge & Iron Works.
Graver Corp.
Pittsburgh-Des Moines Steel Co.

Water Treating Plants
Dearborn Chemical Co.
Pittsburgh-Des Moines Steel Co.

Water Treating Tanks
Chicago Bridge & Iron Works.
Pittsburgh-Des Moines Steel Co.

Waterproofing Fabrics
Barber Asphalt Co.

Weed Burner
Fairmont Railway Motors, Inc.
Woolery Machine Co.

Weed Killer
Chipman Chemical Engineering Co., Inc.
Q. & C. Co.

Welding & Cutting Equipment
Oxweld Railroad Service Co.

Welding, Electric
Electric Railroad Sales Corp.

Welding, Oxy-Acetylene
Oxweld Railroad Service Co.

Well Casings
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.

Well Systems
Layne & Bowler, Inc.

Wheels, Hand & Motor Car
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

Wheels, Wrought Steel
Carnegie Steel Co.

Windshields
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.

Wire Fencing
American Steel & Wire Co.
Anchor Post Fence Co.
Page Fence Association

Wood Preservation
See Preservation, Timber

Wood Working Machinery
American Saw Mill Machinery Co.

LONG LIFE—*plus a wide Margin of Safety*

Make rail cutting safer by using Woodings Track Chisels. Every factor that contributes to their quality is carefully supervised—the forging, the treating, the steel analysis are expertly checked to give added life and a wide margin of safety.

A trial order will prove their real value.

made of alloy steel or electric furnace steel by a company with 45 years' experience in the manufacture of high quality tools.

Woodings Forge & Tool Co.

Works and General Office

Verona Pa.

ALPHABETICAL INDEX TO ADVERTISERS

Up Or Down In Ten Seconds

Moving swiftly, smoothly, unfalteringly, Kalamazoo Timken-equipped electrically-operated crossing gates respond instantly to the will of the operator at the touch of the switch.

Ten seconds is all the time required to raise or lower gates of average length—and a half horse-power motor ample for the purpose—largely through the friction-foiling influence of Timken Bearings.

This means *economy* as well as safety—an item to be considered in buying any type of mechanical equipment.

And while holding friction at bay, the exclusive combination of Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS* and Timken-made steel simultaneously subdues radial, thrust and combined loads—holding wear in subjection—adding years to the life of the mechanism—driving maintenance costs lower and lower.

THE TIMKEN ROLLER BEARING CO.
C A N T O N, O H I O

Manufactured By The Kalamazoo Railway Supply Company, Kalamazoo, Michigan.

TIMKEN *Tapered Roller* **BEARINGS**